anything more to say. It is a very cheery report; everything is before you so completely that it leaves one nothing to add. Our cable is in good working order, our reserve fund is growing, and we hope to pay a larger dividend next year, if all goes on well. I now beg to move that the report and accounts to the 31st December last, now submitted, be adopted.

Mr. F. Youle seconded the motion, which was carried unanimously, and the proceedings terminated.

THE LONDON PLATINO-BRAZILIAN TELEGRAPH COMPANY (LIMITED).

THE net revenue of the year, after providing for debenture interest and income tax, is £9,231 11s. 11d., and £7,898 1s. 7d. is brought from the preceding year's account, making a total of £17,129 13s. 6d. to the credit of the revenue account; to this the directors have added an amount of £1,000 transferred from the reserve fund, making a total available balance of £18,129 13s. 6d. The interim dividend of 2s. 6d. per share, paid on November 1st, 1881, absorbed £4,793 10s., leaving to be dealt with £13,336 3s. 6d.; from which the directors propose to appropriate £5,752 4s. in payment of a final dividend of 3s. per share, being at the same rate as was paid last year, and carrying forward a balance of £7,583 19s. 6d., pending the collection of the debt due from the Uruguay Government. Owing to competition with the Brazilian Government's land lines and to interruptions of the cables, there has been a decrease in the revenue derived under the agreement with the Western and Brazilian Telegraph Company. The receipts from this Company's land lines remain about the same, but difficulty is found in collecting from the Uruguay Government their monthly message account. Owing to economies effected in the administration, the balance credited to revenue on the land lines' account is slightly increased; the directors have taken further steps in this direction. According to the Articles of Association, Francis Pavy, Esq., a director of the company, retires by rotation and offers himself for re-election. Messrs. Deloitte, Dever, Griffiths & Co., the auditors, retire at the meeting, but being eligible, offer themselves for re-election.

THE HAMMOND ELECTRIC LIGHT AND POWER SUPPLY COMPANY (LIMITED).

AT Cannon Street Hotel, on Thursday, at noon, Sir Charles Young presided over a statutory meeting of the above company. There was a good attendance of shareholders.

The Secretary (Mr. P. A. Latham) having read the notice convening the meeting and the minutes of the previous meeting,

The Chairman said: You are aware, gentlemen, that this is merely a statutory meeting of this company, a meeting called for the purpose of satisfying the requirements of Acts of Parliament regulating joint stock companies under the Limited Liability Acts, and that it is merely of a formal character. We have no accounts to submit to you, and no report to present for your adoption; but I have no doubt you would like to have some sort of idea of what we have been doing in the past brief period of our existence; and as it seems scarcely desirable that on this occasion I should go into details, I will just give you a short summary. You are aware from statements in the original prospectus of the company, that we purchased from Mr. Hammond the sole concessions which he had obtained from the Anglo-American Brush Corporation for using and selling their apparatus for producing their well-known, their world-known, electric light, in the important counties of Lancashire, Northumberland, Cumberland, Westmoreland, Durham, Yorkshire, Derbyshire, Sussex, and Hampshire, and also certain valuable privileges in the City of Westminster. The consideration we gave Mr. Hammond was £35,000 in fully paid shares, and also certain founders' shares which entitled him to a participation in the profits of the undertaking after 10 per cent. has been paid to the shareholders, and after a stated sum has been set aside for a reserve fund. Considering the values to which these concessions have now risen in public estimation, and the reasons for hopefulness, the amount paid by you cannot be said to be a very extravagant one. I may add that, shortly after the formation of the company, we acquired from the Brush Corporation the concessions for Warwickshire, Staffordshire, and Worcestershire, for the sum of £6,000, the amount for which Mr. Hammond originally secured the option before the transfer of his rights to this company. Well, gentlemen, on accepting the responsibility for the conduct of your affairs, my colleagues and myself found that we had an excellent basis to start upon. Mr. Hammond had been all round the country, in the north and elsewhere, and you know what a good thing it is to have a good beginning, and you know very well that nothing succeeds like success. The Brush apparatus has been subjected to severe tests and severer competition. The proprietors have never been afraid of either, and the results have justified their confidence. We have been able in various parts of the country to demonstrate the utility of the Brush light where extensive lighting is required, and without wearying you in details, I may state that after an exhaustive trial of our arc light at one of the largest mills in the north, our 16-light apparatus has not only been thoroughly approved, but a 40-light apparatus has been ordered for erection in the autumn. You will readily understand, gentlemen, that the time of year at which we commenced business was not the most favourable for us. When the days are beginning to lengthen out there is not such a demand for artificial lights as when they are drawing in. The assurances we have received have been such as to justify us in giving large orders to the parent manufacturing company, in order to satisfy the demand we have every reason to believe we shall be called upon to supply. We have been successful in cotton mills, and we have been successful in iron mills, where the dirt and dust render the working of electric lights somewhat difficult; but these difficulties we have been able successfully to overcome. I may mention the well-known name of Platt Brothers, at Oldham: that firm has given us an extensive trial, and the result has been that the firm has adopted the Brush system.

We have met with success at galvanising works, at lace manufactories, drapers, outfitters, &c., and at hotels. I am happy to add that we have been chosen by one of the great railway companies in the north to do their electric lighting, and have already erected considerable plant. We have great confidence that another railway company is about to give us an extensive order for the purpose of replacing the defective lighting of another system. You will, I am sure, excuse my not mentioning names on this occasion: it is neither necessary nor desirable to enter into details. Our excellent and most indefatigable managing director, Mr. Hammond, is, I think, desirous of saying a few words to you to-day, and I will leave him to talk to you about the sub-companies which in connection with us have been formed or are in process of formation. I will merely say that after due consideration your directors have thought it the wisest policy to enlist local sympathy and assistance in the creation of local companies, which will naturally be able more readily and more completely to satisfy our local wants. Accordingly, we have entered into agreements with parties in different towns and cities and counties by which, for a consideration, we hand over our rights and concessions, retaining however a valid interest in the work to be done. We have received substantial deposits of cash from responsible persons and parties for the privileges we possess in Lancashire, Warwickshire, Yorkshire, Staffordshire, Sussex, Hampshire, and Worcestershire, also for the City of Westminster. We believe that these sub-companies will be of great service to us, and that the business that will speedily arise through their formation will be a source of considerable profit. Gentlemen,—I will not detain you longer to-day. It is enough for me to add that we have confidence in the material at our disposal, and that we look forward very cheerfully to the future. It has become a commonplace remark to say that the electric lighting was in its infancy. I quite believe it, but it is a remarkably fine infant, and it scarcely requires a prophet to say that the probabilities are that its adolescence will amply fulfil the promise of its youth. In rearing this somewhat portentous baby and educating it to be a useful member of society, we have to deal with strong prejudices and to meet the more powerful antagonism of vested interests. Nothing ripens into perfection all at once; we must have a little patience, and not expect an immediate revolution in the existing methods of illuminating our public places, our manufactories, and our private dwelling-houses. All changes worth having are the results of experiment and patience. It has been well said that science has given to lightning a situation in the Post Office. We shall not have long to wait, I believe, before it still further developes into one of the greatest comforts and conveniences of modern time. I will now call upon Mr. Hammond to address a few remarks to you, in which I am sure you will be interested.

Mr. Hammond said he felt some difficulty in knowing exactly what ground to take up before them that day. Their company was of course on the threshold of its career; though they had had very successful results from its working, it would possibly be better if he gave them a summary of what they were likely to do in the future rather than refer to what took place in what he might call the babyhood of the company. He ventured to take up a short time in that branch, because the excitement that was going on around them behoved all who were foremost in the business of electrical engineers to be calm and perfectly to understand their position, and the shareholders of their company should go away from that day's meeting knowing something more about the property they possessed and the prospects that lie before it. The Hammond Company had taken up the position of being electrical engineers, and in dealing with electricity there was the question standing foremost of electric lighting. The electric light had got such a strong hold upon the public that one was apt to forget that there was anything else that could be done with electricity. There was the question also of power. In many places throughout England there were various mills and so on which were compelled to waste a considerable amount of power. There were mills which generated an immense amount of heat, and this heat, if properly utilised, could be converted into power and into force, which could drive machinery not only at the mill but drive machinery at a distance. Thus there was ample scope for the electrical engineers to work out the most lucrative business in the direction of utilising this waste power, which at this present time was entirely lost. This waste of power generally took place at the spot where the power was not easily applied. But by means of the dynamo machines it was now possible to transfer the power to any distance. In one of their collieries power was now transferred from a distance of fifteen miles, and the work was done with a wire as thick as a quill pen. Not only did the dynamo transfer the electric current, but it was also possible to apply it now in spots which it was difficult to reach. There was a colliery in the North of England where a 300 horse-power pump was at work below ground. That was a very inconvenient place, and it would be very much better if the power could be applied at the top. It was well for the company to dwell upon the question of the latent force which might be electrically utilised in the future. Turning to the question of lighting, as distinct from that of power, he remarked that they had been told lately by one of their leading journals that the electric light was not wanted, and that this *furore* was a great mistake; and that the Hammond Company had been talking a great deal and had done nothing worth speaking of—nothing to help forward the electric lighting in any particular direction. They stood in this position, that at present only those people would take up the electric light who meant to be shareholders in their company; and they must show people in general that there was a reason for the electric light, that it enabled the work of the world to be done in a more expeditious manner than it had ever been done before. The question of the electric light in London was a question now of lighting *houses*. There were millions of houses in the country, too, to whom the light might be applied. But they were all aware that

the application of a new idea to his place of business by a business man was a much more important thing to him than a similar addition to his house. A man did not grudge to do anything for his business that would recoup him; but he looked twice at a £5-note before he laid it out on his home. Therefore house-lighting would necessarily be subsequent to the lighting of public and private works. Throughout this country there were works that carried on operations day and night, as far as it was possible to do so. In many it was impossible to carry on any operations at night by any artificial light, except it was the electric light. He said that advisedly, and he said it in confidence. In the process, for instance, of turning blooms of iron or steel into rails, they knew that the ironstone was excavated in the morning, and the process of dealing with it was so rapid that next morning it came out in the form of rails. In mills of this description, where they might turn out, as he knew two mills which were doing, 8,000 tons per week, they would readily understand that every part of the works must keep pace with every other; there must be no heaping or accumulation anywhere. So soon as the ironstone passed through the furnace it had to be taken red-hot to the cupola, and then pass into the converter, while hot to be rolled out into rails. The rails might have to lie on the ground all night before the process of straightening them could go on in the morning. In Messrs. Bolckow-Vaughan's works, where they would otherwise require a double set of plant for this purpose, they could now by the aid of the electric light use the same plant night and day. There was an immense future lying before the electric light, if by its means it was possible to use plant all the day round. He found, too, that the workmen preferred to work at night. They could then work at night and day shifts, one gang working at night one week, and taking the day on the next: and, as a matter of fact, they must deal with the question of what the labourers did like. There were many millions of plant lying idle in England from their not being able to work at it during the night. The political economists of this country must lay stress upon the fact that it was now possible to work night and day. The electric light enabled them to work through the whole of the twenty-four hours. In the winter months workmen began their work early in the morning, and work on very frequently, with overtime, till 8 o'clock, and were working, in the ordinary way, in a shop lighted with gas. But it had been found that when the electric light had been turned on and flooded the shop, the men who came from the dark and dreary outside, turned into the shop, and the flood of light at once braced them up for their work, and they would start upon their work with the same earnestness as they did in the noontide. One manufacturer told him that since using the electric light the work of his men had been uniform throughout the day, whereas previously it had been 50 per cent. less before breakfast, and attained the same percentage less after four o'clock. As soon as the shades of evening began to fall, the dark and dirty windows obscured the light. That could not be helped. The moment that obscurity occurred in places where the electric light was, that light was flooded into the workshop, and the men saw their way and their work as well as in the daytime. Moreover, they could better see their tools, and turned out better work at that hour of the day in consequence of the aid rendered to them by the electric light. Mr. Gibbs, of the Palmer Shipbuilding Company, whose death they all regretted, told him that in two shops, side by side, one lighted by gas and the other by electricity, the latter shop was yielding 25 per cent. more as the result than the other shop. The men got 25 per cent. more, for they were on the piece. But the greatest thing to be considered in large works was standing charges, and the encouragement was given to employers that their tools would do more work. A few tons, more or less, made all the difference between profit and loss. Further, he repeated, better work was turned out, for the men could see their tools better, and these were not so much in danger of dropping over a machine with the electric light to guide him, and he walked about as freely as in the daytime. Another thing, with the use of gas there was the vitiation of the atmosphere; and as soon as they had made their workmen as good at 7 o'clock in the evening as during the day they had put money into their pockets. Their men were breathing sulphuretted hydrogen all the while gas was burning, and at the end of the day were limp and listless; whereas in electric-lighted shops the men left off as fresh as they were on starting. They were often told that electric-lighting was yet in its infancy. Supposing even that it was in its infancy, they claimed, nevertheless, that Charles Francis Brush, and Edison, and Dr. Siemens, and others who had invented dynamo machines, can claim to have helped forward the progress of the world, and can only be put on the same footing as those who invented the steam-engine and started the railway era. He thought he had shown that the works of various kinds throughout England are anxious to have the light, make good use of it, and make money out of it. A large employer of labour with a large capital would spend some money for a plant if he could get 15 per cent. by doing it, and they would welcome them as friends. At home, too, electricity would be of value, for they could not have their pictures spoiled by gas, and pay to have them renewed; and no doubt they would miss their Spring cleaning (laughter). There was no reason now why they should introduce into their houses that which would injure their health. Gas was not more suited for house-lighting than electricity. If they could get light without heat it must be a manifest advantage. It was surely much better if twelve persons meeting in a room, and all requiring oxygen, to get light without noxious vapours. He was perfectly confident, without being an enthusiast on the part of the company, that the day would come when nobody would have gas in their houses. The pictures in his house were greatly damaged by gas, and in matters of £ s. d. various considerations stood out, the question of which light should be used always being asked. They were told outside that there were fifty lights, and that they could start an electric light company every day. Electricity was a reality and a want that was being called for throughout the country. As to the question when the company would be all right, which was asked by their own shareholders, he replied distinctly in the negative. The number of electric systems, properly so-called, was very limited; and he said that, not as a member of the Stock Exchange, but as one who had observed that in travelling much, a system was the whole thing compact, not a lamp to fit on to somebody's machine. They wanted a system with a dynamo machine and lamp and all complete, with that they could start the light on any premises. The Edison system they found only applicable to house-lighting, and if he came into the streets they respectfully laughed at him. After looking well at the lights in the market, he chose the Brush system as the best for lighting workshops and manufactories. He looked for a system that had some backbone behind it before he put his money into it. He must have a machine that would not generate heat. They now had in America 17,000 Brush lights, of which 1,000 were at New York Station, and the profits realised were enormous. Referring to Messrs. Bolckow, Vaughan, Mr. Hammond said he simply asked, in the first instance, to use their premises for an experiment, and he put up a dynamo machine in the Bolckow-Vaughan works, with which it was possible to run 40 electric lights in one circuit. The opponents of the Brush system said that was untrue, which showed how little the knowledge of electricity had spread. People did not know its value or its capabilities; and even some scientific men said that it could not be done, while all the while perhaps they might be standing over an underground wire that was actually doing the work. The expense of the fitting up had been £2,100. It had been said that they could not light a rail-bank. Well, they had done that too, and men were able to work there night and day. They had 40 lights burning at a rail-bank, and not a single light had ever gone out. Every iron and steel mill in England, upon seeing Messrs. Bolckow, Vaughan, and Co. using the Brush light, and working their plant on their rail-banks night and day, would quickly follow their example. In the plate mills the plates were rolled day and night, and were often cut at night too large under the light given by gas. When taken to the ships it was often found that they would not fit, and as they could not be kept till they might chance to fit, they were often sent back to be remelted. At the Bowesfield iron works, the largest plate mill in the world, they got six lights, and the next week they talked of getting 100. But in all these instances they had only shown in these places a little sample of their wares; they hoped it would spread in every direction next winter. In Gray's shipyard they had put up 16 lights for a month, and at the close they had got an order for 16 more, and in a telegram received that morning, Mr. Gray said, "Your electric lights continue to give satisfaction; we find them very useful for ships repairing in the graving dock." Not one single place when they had put up their light would go back to gas to-morrow. The Mostyn Coal and Iron Company, after using the lights for nine months, expressed a strong opinion in favour of them—they had no trouble in keeping them in order, and as regards their brilliancy, they could work their railway traffic at the discharging dock without the slightest difficulty, and that its cost to them was about 1½d. per hour per light. Messrs. Bolckow, Vaughan, and Co., said that their results were so surprising that they would be handed to the president of the Cleveland Institute to be made known publicly. Messrs. Kitson, of Leeds, had used the light two winters, and next winter they would probably be extending the system in their works. Messrs. Fowler and Co., Leeds, said that the lighting with the Brush system was very remarkable. He believed that he was in the control of the best light, he considered, that existed. That had been proved to him, not only by figures, but by the confidential conversation of men of business in various parts of England. Mr. Colman, of Norwich, had made up his mind to have a Brush light, and, after lighting for a month on trial, the system was continued there also. He had set himself, he said, in conclusion, to find out the best thing, and to develop its use he had decided to start the Brush Company. Although people were almost daily coming to him with dynamo machines, he still said he had nothing to fear from them. They expected to make an immense amount of money from their Indian concessions. He remarked that he was certain that they had not only the best machine, but the best organisation, and could put up the electric light in thirty-six hours. They had recently met a contract to light Middlesborough with sixty-four lights in three weeks, and he should like to hear the man in England who would say that he had a better organisation or system than the Brush. They had established the Hammond Electrical Engineers' College, and found men ready to pay the required premium. Now that they had got the best machine and the best organisation they must cover the country, and in order to keep the business of the company more immediately under their eye, they had established fixed centres in Middlesborough, Liverpool, Sheffield, and Whitehaven, where they sold the right to people who were practically their agents. They had taken that step after careful consideration, believing it best for conserving the interests of the company. He stood prepared for any business as electrical engineers, with an organisation second to none, and with a knowledge that in America, where the Brush system has got a few years ahead of them, shares now fetched a hundred times more than was originally given for them.

The Chairman said there was no other business that day.

Mr. Reynolds said he thought that they should pass a vote of thanks to Mr. Hammond for his scientific as well as practical address. He was sure they must have been delighted to see the interest which Mr. Hammond took in the company. In the face of people continually saying, "I have a dynamo that will excel the Brush," and yet not attempting to bring it into the market, they must all admire the courage which Mr. Hammond had shown in putting his money into the undertaking. He hoped he would make his fortune out of it. The vote of thanks was seconded by a shareholder, put to the meeting, and carried unanimously. Mr. Hammond acknowledged the compliment, after which the customary vote of thanks to the chairman was passed by acclamation, and the meeting separated.

THE TELEGRAPHIC JOURNAL AND

Electrical Review.

Vol. X.—No. 235.

FIRE RISKS AND THE ELECTRIC LIGHT.

In our issue of the 13th inst. we reprinted the rules of the Phœnix Fire Insurance Company for electric light installation, compiled by Mr. Heaphy, C.E. The subject generally has created considerable interest in all quarters and we believe that the views we shall express on the matter will be endorsed by the majority of electricians. In the first place we firmly believe with Messrs. Crompton and Gordon that the use of the electric light *may* be rendered absolutely safe from any risks of fire if the machines, lamps, and conducting wires employed are selected and arranged by competent and skilled electrical engineers. We cannot, however, agree with a statement which occurred in the first lecture on "Insurance Companies and Electric-Lighting" delivered at King's College on Wednesday, May 3rd, by Mr. R. E. Day. The lecturer, in speaking of electricity having high or low electromotive force, compared the electric current to water or steam flowing through a pipe, and said that as the risks of accident are greater when steam is conveyed through a pipe at high pressure than when it is at low, danger to life and property is much more likely to be occasioned by leakage from defective insulation where high pressure electricity is employed. The mode of comparison adopted by Mr. Day very aptly illustrates the various phenomena of electricity, and may be in many cases happily employed, but in this instance he apparently forgets that for high pressure steam the pipes would be made correspondingly strong. The lecturer must be aware that one of the chief claims brought forward by the advocates of low tension currents is the extremely low insulation required on their wires, and therefore the cheapness of such conductors. Leakage is consequently as much to be expected from a circuit of low tension currents (such as those used with incandescence systems) with low insulation as from high tension and highly insulated wires—more so in fact, on account of the number of branch circuits employed in lighting by incandescence, and therefore the greater chance of the current finding weak places. Danger to life may certainly be expected from high electromotive force, but fire risks are more liable to occur from machines of low tension and great quantity, the heat developed by these latter being so enormous compared with that generated in circuits employing electricity of the other character. Again, our experience up to the present goes to show that the majority of little fires connected with the electric light have been in those systems employing incandescent lamps. However, fire need not be apprehended in any case if sufficient care be taken to secure the necessary proportions of conductor and insulator, and also to insure competent supervision of the installation.

It was stated by Messrs. Crompton & Gordon that at a meeting representing the principal electric light companies the rules compiled for the Phœnix Office met with general approval, and these gentlemen also think that their adoption should be everywhere insisted on by fire offices. We must confess to a feeling of surprise that some of the rules were not modified or amended, as in parts they appear to us contradictory and utterly opposed to the expressed belief of the above electricians that the use of the electric light is absolutely safe. Rule I. says :—"All rods or wires in a building to be so placed as to be thoroughly and easily inspected," yet part of Rule 3 distinctly states that "Wherever practicable the rod (or wires) should be inclosed in iron, brass, lead, terra-cotta, or earthenware pipes, the space between the rod (or wires) and the pipe being completely filled with a high insulating compound. Or the rods (or wires) should be thoroughly well insulated with a material as non-inflammable as possible, and might be placed in slate beading or slate boxes."

We fail to see how the conducting wires are to be *thoroughly and easily* inspected under such conditions. Rules 2 and 13 appear to be slightly at variance with each other. They are as follows :—

"2. All rods and wires to have sufficient sectional area, so as to allow at least 50 per cent. more electricity being safely sent through them than will ever possibly be required for the lights they supply.

"13. Wherever a branch wire is led off the main conductor to supply current for one or more incandescent lamps a short length of lead or other fusible wire must be inserted between the main conductor and one end of the branch; and the lead wire must be of such section and nature that if the current passing through it exceeds the normal current by 50 per cent. then it will fuse and disconnect the branch."

It appears from this that the electric light companies would have to go to unnecessary expense in providing extra large wires for no particular advantage. If a circuit must automatically cut itself out by the addition of 50 per cent. in the normal current strength, Rule 2 seems superfluous. In rule 17 it is laid down that "No ground circuit is allowed," yet in the concluding rule it is stated that when the electric light is intended to be used, parties must inform the insurance offices "whether there is to be a metallic circuit."

We think that no such stringent rules as those adopted by the Phœnix Fire Office are required, and we do not believe that electric light companies should be bound down in the manner set forth. If all the existing fire offices adopted such inconvenient rules, there would be fair opportunity offered for the formation of insurance companies intended to deal specially with insurances where the electric light was a factor to be more reasonably dealt with. We have before pointed out that the general introduction of the electric light will much depend upon the reduction of its present cost; but if it is necessary that all installations should be put up in accordance with Mr. Heaphy's rules the cost of fixing will be greatly increased. What we require now is that the whole apparatus connected with electric lighting should be cheapened in every way; and, as the cables for connecting the lamps and machines generally form a heavy item in the total expense, we think that the responsible electricians of the companies should be allowed to use their discretion—subject to the approval of insurance inspectors—as to how the wires may best be arranged, more especially if the prophecy of Messrs. Crompton and Gordon, that electricity will shortly be supplied on at least as large a scale as gas or

water, is to be fulfilled. Even for streets it is not so good for india-rubber or gutta-percha covered wires to be made into a compact mass with some insulating material, as to allow water to percolate into the pipes; for the majority of electricians are aware that gutta-percha in particular is practically indestructible in water.

If the underground leads for electric lighting are made according to such specifications as those compiled for the manufacture of cores in submarine cables, there ought not to be much fear of any deterioration in the insulation for some years to come. Everything considered we do not think that these rules will ever be carried out in their integrity, for they are formidable enough to induce the supposition that installations of electric lighting, instead of being absolutely harmless if "certain definite and well understood rules are observed," are attended by a considerable amount of danger, the risk to property at present appearing to claim—when the danger to life from the use of high tension currents is considered—much more than its requisite share of attention.

THE BAUDOT TELEGRAPH.

(*Fifth Article.*)

Combiner.—The combiner is that part of the apparatus that collects the groups of successive emissions corresponding to each sign (letter or number), and finally reproduces it in printing type on a slip of paper. It is on this part of the apparatus that the inventor is most to be congratulated; upon it he has brought to bear all the resources of his ingenuity, and he has introduced a really new principle into telegraphy.

The problem of printing the signals transmitted through the lines has already received many astonishing solutions, but, until now, the printing has always been effected by a mechanical action immediately following the arrival of the current, and to a certain extent barring the way to subsequent currents, so long as the quantity or intensity required to produce the desired effect was not attained. This is a new idea: to collect a group of emissions (the group of 5 in this particular case) forming a signal, and in some manner to store up these emissions in mechanism constructed to reproduce them, at the same time leaving the line clear for the following effects. At the moment when the mechanism acts the printing is effected, and is performed independently of all the subsequent workings of the wire.

This is the principle of division of labour applied to its full extent; and M. Baudot bids fair to develop it still more in other inventions.

We must, for the present, confine ourselves to the combiner of the actual apparatus.

The reader will remember that at the beginning of this series of articles we explained the effect of the combiner by the action of a succession of levers, the positions of which repeated at each combination the movement of the armatures of the receiving electro-magnets.

We had deduced from the repetition of the combination of the armatures by the levers of the combiner the possibility of producing a mechanical effect resulting finally in printing. This was, of course, premature; the connection between these positions of the levers of the combiner and the positions of the armatures of the electro-magnets had not been pointed out. A more complete investigation will make it clear to us now.

We will follow in the path indicated by M. Baudot in the course adopted by him at the Administration of Telegraphs.

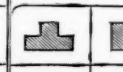
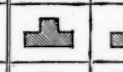
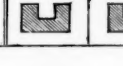
And first let us endeavour to picture to ourselves the combinations constantly alluded to in this article; we will try to give a clear explanation of them.

It has been shown that with two kinds of action (positive current and negative current), by always using five emissions, 32 combinations can be formed. The same reasoning will hold good if we suppose that, with the two kinds of action, + and —, only three emissions are employed; we shall thus simplify our explanation without affecting the truth of the demonstration.

The combinations possible under these new conditions are only eight in number, as represented below:—

Numbers.	Combinations.			Signals.
1	+	—	—	A
2	+	+	—	B
3	+	—	+	C
4	+	+	+	D
5	—	+	+	E
6	—	—	+	F
7	—	+	—	G
8	—	—	—	Blank

No special method has been followed in arranging the signs + and — in the above table; all the horizontal rows can be permuted so as to form altogether $(1\times2\times3\times4\times5\times6\times7\times8)$ or 40,320 similar tables. We mention this to show that we are reasoning on a general illustration. Let us now suppose the signs + and — to be replaced by little cubes, on the upper surfaces of which are projections or hollows according to the sign represented and susceptible of being displaced along the vertical or horizontal rows. We shall then obtain another representation of the above table.

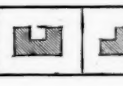
Numbers.	Combinations.			Signals.
1 ____				A
2 ____				B
3 ____				C
4 ____				D
5 ____				E
6 ____				F
7 ____				G
8 ____				White

Let us take for the sake of illustration the last row corresponding to three — signs or three hollows.

8 ____				White

This combination will be our indicator, for it is clear that when the mechanism dependent on the current has realised it, the letter to be printed will be designed and the printing will necessarily follow.

Let us suppose that we wish to reproduce the letter E, corresponding to the 5th row.

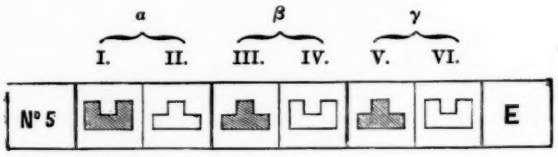
5 ____				E

We shall further the solution of the problem if we trans-

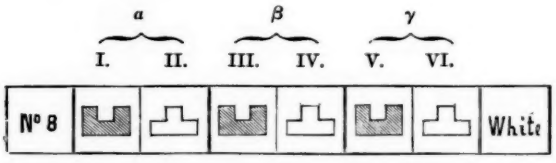
form the combination No. 5 into the indicator, and then transpose the new combination of the 5th row to the 8th row.

In order to transform the 5th combination into the indicator, let us suppose that each horizontal row contains six divisions instead of three and that they are so arranged that the supplementary divisions present hollows when the principal divisions present projections, and *vice versâ*.

The 5th row would then be represented thus :



We will now show the indicator under this new system.



On comparing the last two diagrams we see that in order to make them correspond two changes will be necessary :—

Permutation of divisions III. and IV. (group β) ;

Permutation of divisions V. and VI. (group γ).

This being effected, a transposition of 5 to 8 will bring about the desired result.

Up to the present nothing has been said of the mechanism constructed to carry out this idea. It is in this that the strength of the invention lies. Part of the work expended is employed by the current for storing up the signal ; the other part which acts independently of the current reproduces at leisure this temporary impression and gives it form as a bold Roman letter. The two functions are entirely separate ; and this, we repeat, is the original part of M. Baudot's invention.

The two consecutive operations just indicated, viz., the transformation of the combination of one row and the transposition of the modified combination to the row of the indicator, are effected as follows :

Each of the groups α, β, γ, in the diagrams may be considered as a double path, sometimes hollowed out, sometimes in relief, according to the requirements of the table. Railways have made us familiar with the system of points. We will conclude that a slide for each group passes over the vertical rows, sometimes over one path and sometimes over the complementary path of the same group. The operation of transforming the combination in a certain row is then easily understood ; the work of the current will consist in switching the slide, and this switching will effect the transformation required.

Let us follow the slide switched so as to effect the transposition from 5 to 8. At 6 and 7 it will meet with accidents which we need not take into account, but without fail at 8 the three styles, arranged beforehand, of which it consists, will meet three hollows and will fall ; if they are connected to a movable frame, the fall will cause a displacement of the frame, and this mechanical movement will produce the impression.

Thus, to sum up, 1st phase, the current : pointing of the slide ; 2nd phase, the mechanism : fall of the slide. It is evident from the explanation that the fall of the slide for a given pointing will always occur at one particular place and there only. The constructor can make his choice from the 40,320 tables that we have computed, as the reasoning holds good for each of them.

Now we are in a position to complete the definition of the functions of the combiner : when the current on arriving at its destination produces a movement of the 5 armatures so as to reproduce the combination formed on the keys of the manipulator, these 5 armatures influence the points which guide a collector composed of 5 styles, in 5 paths so arranged that at a certain point the printing of a letter shall be effected.

Practically, the instrument has 10 paths (5 normal and 5 complementary)—these are circular ; the pointing of the brushes of the collector is effected in the space of one single sector. The result is that the falling point of the chariot varies on the circumference described ; it is arranged so as to correspond exactly with the order assigned to the combination in the table which has served as a basis for the construction. It is no longer the combination which is transformed to go to the indicator, but the indicator comes to meet the combination.

(To be continued.)

ON THE NATURE OF THE INDUCTION CURRENTS DEVELOPED IN MAGNETO OR DYNAMO-ELECTRIC MACHINES.

By Th. du MONCEL.

MANY people write and discuss about induction currents, many make calculations on them, but very few trouble themselves about the causes of the induced currents developed in these machines. The result is that very often the effects anticipated or calculated are not realised. It seems to me that the study of the causes ought to precede that of the effects produced, for, as we have long known, the causes which may react upon the creation of induction currents are complex, and it is important to avoid those likely to develop opposing influences. In France, science is to some extent restricted by being confined within certain programmes, and a principle in order to be admitted has to be accepted by a clique of theorists, who generally show great reluctance to change old erroneous notions, and very often write in order to suppress what is not in accordance with their ideas. For the effects of induction we are referred to the laws of Lenz, and the fact is overlooked that data which may be accepted as regards direct reactions, exchanged between an inductor and a helix placed above it, are no longer applicable to reactions of induction which take place internally. In England the principles have long been studied which determine the creation of induction currents when a spiral is moved in different parts of a magnetic field ; but in France, Ampère's magnetic solenoid always forms the starting point, and instead of taking into consideration the lines of magnetic force, people investigate the manner in which the wire of the helix is brought before that part of the solenoid which acts upon it, so as to deduce therefrom, according to the laws of Lenz, the nature of the current produced. The result of this method is, not only that the effects to be noted down are much longer and more circumstantial, but also that errors very often occur. In proof of this I need only mention what happens when a coil is made to move before the pole of a magnet. If the movement takes place laterally and perpendicularly to the axes of the magnet, a current the reverse of that in the magnet should be produced according to the laws of Lenz. Such a current is obtained when the movement is effected above the polar extremity of the magnet ; but if it takes place below and at a tangent, this is no longer the case, and the current produced is direct. By the principle of the lines of force which is admitted in England, all this is easily explained, and there can never be any doubt on the subject.

This faulty method of studying the effects of induction has been the cause of so many inaccurate theories being formed as to the effects produced in the Gramme machine. In this machine several influences are at work, and in order to appreciate them they must be studied singly.

Let us first consider what will happen when one of the sections of the circular armature is brought alone (*i.e.*, without any iron core) before one of the inductive poles. According to what has been said above, a direct current will

be developed, since the lines of force of the magnetic field cut the coil at its starting point and not at the moment when it arrives at the inductive pole. This current will, however, be very feeble in consequence of the obliquity of the lines in relation to the coils of the helix. Let us now see what happens when this coil, instead of moving unsupported, moves on a bar or arc of iron. The latter, in consequence of its position before the inductive pole, is polarised and becomes a magnet having its neutral line in the middle of its length. If the coil be placed at this middle point and be made to move towards the inductive pole, it will abandon a position in which the lines of force of the magnetic bar cut it almost normally in order to take up one in which these lines do not cut at all; and then we should obtain a current which is direct in relation to the magnetic current of the iron core, and this current is consequently of the same kind as that provoked directly by the inductive magnet on the wire of the coil.

In this last illustration the iron core is supposed to be immovable and consequently polarised permanently. But in a Gramme machine this is not the case; and the question was whether the movement of the bar of iron in a section or coil supposed to be immovable does not give rise to induced currents, under the influence of the reversals of polarity of the magnetic particles influenced by the polarising action of the inductive pole.

The experiment is easily made. It is sufficient to fix the coil on the inductive pole itself, in such a manner that the plane of its spirals shall be parallel to that of the axis of the magnet, and to cause to pass through this coil a rather long bar of iron, either straight or curved. On making the experiment, it is found that a very strong direct induced current is produced, which preserves the same direction as long as the movement of the bar lasts. (I have experimented with bars more than a metre in length.) On examining what then takes place in the magnetic field, we see that it must be so; for as the bar penetrates into the coil, we see that the lines of force corresponding to the central curves of the magnetic shadow, which at first cut the plane of the coil, become straightened successively and spontaneously, and consequently produce an effect analogous to that which would have been obtained by suddenly displacing the coil from the neutral line of a magnetised bar to its poles. It is thus again a direct current that is obtained, and that is added to the two others. In order to distinguish these currents from those due to the two other kinds of action, I have designated them as currents of reversion of polarity, for naturally the direction of the current changes with that of the movement of the magnetic core. The question was to find out the relative importance of these three kinds of induction clearly observed in the Gramme machine. Now in the numerous experiments that I have undertaken in connection with this subject, I have found that the currents of reversions of polarity gave rise to galvanometric deviations of 60 to 70 degrees, whereas the others only produced deviations of 36 to 40 degrees for the one and seven to eight degrees only for the third when the bar and the helix were displaced simultaneously, as is the case in a Gramme machine. The three actions were successive, and gave rise to a deviation that amounted to 90 degrees. The cause of induction unstudied up to the present was therefore most powerful, but we do not say that the Gramme machine is better than others on account of the fact that it produces three kinds of induction developed in the same direction. We know that induction, like magnetism, becomes weakened by being divided and carried in several directions, and it may happen that by placing one only of these inductions in its most favourable conditions, we may obtain effects as powerful as with several together; but I think that we can more easily succeed in realising the most favourable conditions with several inductions than with one, and in my opinion this is what has constituted the advantage of the Gramme machines.

I have treated in detail all these points in several articles published in *La Lumière Electrique* of Nov. 1st, 1879; Oct. 15th, 1881; March 11th and 25th, 1882; and April 8th, 1882. In the last of these articles I have even shown the confusion which resulted from the method adopted in France of teaching the phenomena of induction; I have shown that all these phenomena might be anticipated and explained by adopting the English theory.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

ELECTRICAL ENGINEERING.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Seeing there is a likelihood of a wide application of electricity, I would like to make a son of mine an electrician. Would you be good enough to say, after he would pass out of a school of preparatory training (such as that I saw last week recommended by a correspondent—I refer to the "School of Submarine Telegraphy"), would he then be in a position to take a situation under one of the electric light companies, or would he require to serve a time under them after?

What is the probable salary of electrical engineers?

Your attention to the above would greatly oblige, yours truly,

CHAS. CAULFIELD.

Pentonville, Belfast, *May 16th*, 1882.

[Our correspondent is quite correct in his belief in the wide applications of electricity in the immediate future. We believe the school in question would guarantee an appointment to a promising pupil. The salary, of course, would depend upon ability and experience, also upon the standing and prospects of the company by whom he was employed. Perhaps the Hammond Electrical Engineering College would be the best selection for our correspondent to decide upon, for the probabilities are that a pupil when competent would find immediate employment in the Hammond Electric Light Company. We express our belief that the demand for competent electricians will be greater than the supply.—ED. ELEC. REV.]

CANDLE-POWER OF ELECTRIC LAMPS.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Referring to your correspondent's letter on "The Candle-Power of Electric Lamps," I should like to ask him, "How can the company which he refers to be financially a great success, and go on the even tenor of their way, flourishing, if they have been turned out of most places where they have tried their broom?" (as he terms it).

As regards this latter statement, I should advise him to get a list of all the places, works, &c., where the Brush lights have been put up, and are now in working operation. I think he will find it far exceeds that of any other company. In America it is said "that 49 out of every 50 are Brush lights." Referring to the candle-power of these lights, he speaks of "the necessity of having a practical test applied regarding the true candle-power of 'arc' lights."

Now, if he refers to the report of the "photometrical measurements" taken by Professors Ayrton and Perry at the Paris Exhibition (surely this is a practical test), he will find, amongst others, that the "Brush" light was 2,063 candles per horse-power, or per lamp (as each lamp absorbs about one horse-power). Now this, and the words "2,000 candle-power," on the Brush prospectuses, refer to the candle-power of the naked light.

But if the lamp is surrounded with an opal globe (as is usually the case), the light is of about 1,000 candle-power, as the globe absorbs about 50 per cent. of the light. As regards it being of an unearthly colour, I would ask him, Is it more unearthly than any other arc light? Do not all "arc" lamps give the same white light, with very little difference in shade or tint? He also says that "it must be made more steady." I am sure, if he looks at the light without partiality, he will find that it is as steady, if not more so, when compared with "arc" lamps of most systems. "Less liable to extinction." If in good order, I contend that they are not liable to extinction. As an example. At

the Paris Exhibition a 40-light machine was kept running sixteen hours per day for twenty days, and there was no accident of any kind to any lamp or machine.

One word more with regard to the success of the Brush Company. I would say, using your correspondent's own words, that the mere fact of their being "Brush prospectuses for all climes," and the eagerness with which the shares of the different companies connected with this system are bought up, show that the Brush system is (in the strictest sense of the word) a perfect success, and also that "the public" have great faith in it.—Yours faithfully,

May 20th, 1882. R. L. C.

SPAGNOLETTI'S FIRE-ALARM SYSTEM.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Without any desire to disparage the ingenuity of Mr. Spagnoletti's fire-alarm system, I wish to point out that there appears to me to be a great similarity between his instrument and McCallum's Globotype Telegraph. I see, from a pamphlet Mr. McCallum gave me in 1873, his instrument was invented and patented so far back as 1855.

While writing on the subject of similarity of instruments, I would add that I think it a pity previous inventions can be so closely followed without acknowledgment to the first inventor. It is one of the evils of our patent laws that the first inventor, unless a man of means, is unable to defend his right without the chance of ruining himself. This is well known, and advantage appears to be freely taken of it.—Yours faithfully,

May 18th, 1882. M. S. T. E.

SECONDARY BATTERIES.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Some time since I read an excellent article in your valuable journal in which you very justly deprecated the loss that would be sustained did the very unfortunate differences that existed between rival men and companies on the subject of electrical science continue, and much capital would be spent in litigation that might be more profitably spent in furthering research. In this I must fully endorse your views, and what I am sure you will equally regret, that a further obstacle to progress has been introduced, and in two contemporary journals very severe criticism has been made affecting the personal characters of two gentlemen whose names are well known in connection with secondary batteries; and with regard to one whose personal acquaintance I have enjoyed for upwards of 25 years, I think it only his due to say, he (Mr. John S. Sellon) is a man of the highest commercial reputation, deeply respected in the scientific world, aiding with the resources at his disposal, and free from pecuniary benefit, every inquiry the result of which may prove a boon to his fellow man; and, not wishing to trespass further on your valuable space, can only hope that the day is not far distant when, as far as electrical science is concerned, all disputes may be amicably arranged, and private prejudice give way to union of purpose for the public weal. Yours truly,

London, *May 23rd*, 1882. JUSTITIA.

HOW THE ELECTRIC LIGHT IS PRODUCED.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—In your issue of April 15th you publish portions of a letter entitled "How the Electric Light is produced." In regard to paragraphs 1 and 2, which you seem to doubt: Can you tell me what electricity is? If so, I should be much obliged. In paragraphs 5 and 6 you say the writer has contradicted himself; but it seems to me that he is perfectly right. He says magnetism and electricity are nearly akin, and then shows in what slight respect they differ; so it is not clear to me how he can "entirely negativate" his statement. In paragraph 11, I believe it must be plain to everybody that the writer's object is to make his subject as clear as possible. What, then, would be the use of going into discussions on complex magnets? Everybody does not know that a magnet has two poles; and surely, to understand his subject, they do not need to know more. Nor is it so well known to the world that diamond is a form of carbon. It would much oblige me if you would point out the "extreme nonsense" in the two concluding paragraphs—or, indeed, in any of them. You call them fallacious and misleading statements. I cannot see the truth of this, and feel sorry that you should have wasted so much space on such unmeaning criticism.—I am,

Yours truly,

Maskell Street, Manchester. LIGHT.

[We regret that our criticism has no meaning for our correspondent; but that does not affect the truth of our remarks, as he will probably acknowledge when his acquaintance with the subject of electricity is more matured than appears to be the case, if we judge by this effusion of his which is now before us.—ED. ELEC. REV.]

[We have received a letter signed "A Subscriber and Electric Light Shareholder," but the writer has accidentally omitted the address-card, which he says was inclosed.—ED. ELEC. REV.]

THE TELEPHONE CASE.

(*Continued from page* 370.)

Q. Except the one which is the simplest?—A. Here is one with the strips (*producing another instrument*). That speaks perfectly. In that one the stuff tumbles about.

Q. We need not trouble about any particular experiment; this is nearer to it, no doubt. Even here you have got a very wide strip, which must have a certain tympanic action?—A. A mere wire placed across it speaks perfectly.

Q. Let me see the instrument where you have tried the wire across; you have not shown it, you know?—A. It is a coil wire. In the place of the upper electrode, I simply coiled the wire into a spiral. In this instrument I placed muslin over the tube and then restored the mouthpiece. This is the one with the two electrodes at the bottom side by side, a perfectly free surface. The muslin is simply to prevent the powder being blown away; it would speak perfectly well without it. In the place of the muslin I put an ordinary Edison tympan on the top, and then fastened it up as before; the speaking was impaired somewhat.

Q. I suppose you must have a certain amount of electrode in order to operate upon the coke which you have in the Hunnings instrument?—A. Obviously.

Q. If you do not it will only operate partially and not completely?—A. Quite so.

Mr. JUSTICE FRY: If I understand rightly, the expansion of the electrode in the form of a disc is essential to the operation?—A. I should not say so.

Q. Some expansion of it?—A. Some expansion is necessary for electrical purposes, not for acoustic purposes.

Q. The acoustic results depend on the electrical conditions, do they not? If I rightly understand, the operation of the current upon the coke is co-extensive to some extent with the expansion of the electrode; is that so?—A. I think you may take that to be so.

Q. I suppose you have two small points acting as electrodes, and you have those two points isolated among non-conductors. I suppose the portions of the coke would be part of the line the current passed through?—A. Yes.

Q. Supposing the points are generally expanded the operation will be extended by increasing the area of the coke through which the circuit would pass?—A. Yes.

Q. Then the most perfect condition of the electrode is that which covers the entire surface of the coke?—A. Unquestionably.

Q. Then we come to this, that practically your electrode is better if it is coterminous with the area of your box?—A. I do not think I should go so far as that, because if you are speaking to that instrument ——

Mr. PEARSON: Which one do you want?—A. The gelatine instrument. There the electrodes are two rings, a split ring inside.

Mr. JUSTICE FRY: The electrode is the ring; the whole area of the coke is within the ring, and therefore the electrode is coterminous with the coke. In that case the passage of the electricity is lateral; therefore it passes through the whole of it?—A. There I entirely agree.

Q. It comes to this, then, that in whichever direction the electric current is to pass, your electrode must be equal to the extent of your containing-box?—A. Yes.

Q. And it comes to this, that the electrodes will not work in the case in which they operate above and below unless they are at the side of the box; they will not work so well?—A. Not so well.

Mr. PEARSON: But at the same time if you put the electrodes at the side, as they are in that instrument, you do not speak through those electrodes, but through the gelatine at the top?—A. Undoubtedly.

Q. Therefore the electrode is not a tympan in that case?

Mr. JUSTICE FRY: The electrode operates no doubt in two ways: it acts in the same way as the gelatine does, and it acts in the same way as an electrode does. If you make it act as an electrode it must

be co-extensive with your box. The more that is so the better your action is?—A. I have tried wire gratings; they speak perfectly. The objection is that the particles tumble out.

Q. Theoretically, the action of the tension regulator must increase with the extension of your electrode?—A. Yes.

Mr. PEARSON: That is to say, it is the difference between a larger and smaller machine?—The current has freer passage.

Mr. JUSTICE FRY: And you have more coke to operate upon?—A. More loose particles.

Q. And more opportunity of producing the difference in the current?—A. More opportunity of producing the action which Hughes describes.

Q. Now with reference to these experiments, did you try a similar experiment with one of Edison's patents?—A. I did.

Q. What was the experiment?—A. The experiment was this. I took an ordinary Edison carbon transmitter, and adjusted the buttons to get good speaking. I then removed the buttons, after testing the perfection of the instrument, and put two circular electrodes round the button, precisely analogous to the gelatine transmitter. I then again put the parts of the instrument together exactly as they were before, only leaving out the electrodes that Edison put in. With this arrangement no speaking can be heard, however careful the adjustment may be.

Mr. JUSTICE FRY: I do not know that I quite follow that. You have no electrodes in the second edition of the experiment?—A. Clearly; or the current would not pass.

Q. Did the current pass?—A. A strong current was passing through the instrument.

Mr. PEARSON: The electrodes were at the side of the button?—A. In every respect analogous to the gelatine.

Q. That is to say, they were a ring but in two, so to speak?—A. And clasping the button.

Mr. JUSTICE FRY: I follow you rightly, to illustrate the view that the gelatine operates better in immediate relation to the points than the Edison operates through the tympan and the coke—the result in the one case is satisfactory, and in the other it is not. I only want to understand your conclusion from it?—A. My conclusion from it is this—that in using the Edison carbon transmitter you must have a tympan and screw adjustment, and an electrode above and below the button to work well; if you alter any one of those parts you spoil the working. If you move the tympan and have only the electrode above and below you have no means of adjustment, and consequently it cannot speak well. If you leave the tympan and remove the electrodes, passing them round the button in this form (*describing*) and then adjust them as before, you would have no speaking, simply because you have not the means of adjustment. There is no possibility of talking through this carbon. There is a carbon telephone in all respects the same as Edison's, only with electrodes hopelessly bad.

Mr. PEARSON: If I understand you, Professor Barrett, what you say is this, that in using the Edison instrument you must have the vertical pressure produced by the tympan, and the machinery upon the upper electrode responded to, if I may say so, by the lower electrode; and if you take out that machinery which Edison, in order to produce that pressure,—which you do by putting the electrodes at the side instead of putting them under his machinery—Edison's instrument will not work.—A. It will not.

Cross-examined by Mr. WEBSTER.

Hunnings' transmitter will not work, "commercially," with lampblack, as it fails after being used a short time, in consequence of the particles of lampblack cohering.

Mr. WEBSTER: Now, Professor Barrett, would it not be a perfectly accurate description of a Hunnings transmitter to say that the foil acts as part of a vibrating diaphragm, and is in immediate contact with a very thin layer of granulated coke, which fills a small cavity provided with a brass plate at the bottom?—A. It turns on the meaning of the word "diaphragm."

Q. Assuming that the platinum foil may be properly called a diaphragm, I put it to you, is not that a perfectly correct description of the action of the Hunnings transmitter. I will read it again if you want me to.

Q. "This foil acts as part of a vibrating diaphragm, and is in immediate contact with a very thin layer of granulated coke, which fills a small cavity provided with a small brass plate at the bottom." Is not that a correct description of the action of the Hunnings transmitter?—A. It is a very loose, rough way of describing it.

Q. Is it not a correct loose-and-rough way of describing it?—A. I should not say so, except in a very broad way. It is not a scientific way.

Q. I did not say scientific or broad; is it not a true description of the action of the Hunnings'? "This foil acts as part of a vibrating diaphragm, and is in immediate contact with a very thin layer of granulated coke, which fills a small cavity provided with a brass plate at the bottom." Is that a true description, assuming the word diaphragm is applicable to platinum foil?—A. It is not true.

Q. What is untrue?—A. If you will allow me to explain it ——

Q. You now have an opportunity of explaining—you can do so.—A. Simply because the vibrations which are communicated first of all to the electrodes are distributed throughout the whole of those loose granules, and there are various degrees of contact produced in those granules; consequently there are various degrees of electrical resistance, and so of the strength of the current, a wholly different mode of action to that which takes place in the fibres, or loose lampblack, connected with the telephone.

Reiss's apparatus the witness considered was intended to work by variation of the current, and not by make-and-break only, as was generally supposed till within a short time ago. Reiss's own description of his apparatus had only recently been properly understood. One distinguishing point in the Hunnings transmitter was that the resilient action was in the coke particles themselves, whereas in the other transmitters it was a spring.

Mr. WILLIAM EDWARD AYRTON, *sworn*.

Examined by Mr. HEMMING.

The witness considered that the tympanum is essentially absent from the Hunnings transmitter. The platinum foil he did not think at all takes the place of an acoustic tympanum.

Dr. HOPKINSON, *re-called*.

Further examined by Mr. WEBSTER.

Witness stated that he had tried lampblack in a Hunnings transmitter, and with excellent effect.

Speech of Mr. HEMMING, Q.C.

After the conclusion of the evidence, Mr. Hemming, counsel for the defendants, said that it would not be necessary, except in one or two instances, to refer to many details. It would be convenient that he should enumerate the leading points on which his side relied as their case. With reference to the infringement of the Bell receiver with which they were charged, they said—First, that the Bell receiver was anticipated by Reiss. Mr. Justice Fry asked if he meant both Reiss's. Mr. Hemming said that Reiss's No. 2 came nearest to it, but his contention would apply to Reiss's No. 1 as well. Secondly, the Bell receiver was anticipated by the Glasgow receiver —which was Bell's own instrument sent to Sir W. Thomson by Bell himself. Thirdly, there was an anticipation of a certain portion of Bell's patent by the publication in the *English Mechanic* of August, 1876, of a description of the goldbeater's-skin apparatus of Bell. Mr. Justice Fry said that the question would have to be considered how far the mere exhibition of the Glasgow receiver constituted a disclosure in face of the fact that it was not known how it worked at the time. Mr. Hemming said that he meant to refer to the evidence on that point. Their only other point was this: Whether Bell's receiver was anticipated or not, they said that the specification was bad on the face of it, because the disclaimer expressed a claim to something which was not claimed by the specification itself. As to the Edison their points were these—In one sense it might be that Edison's telephone was not anticipated, but there was always a difficulty in separating the two questions of anticipation and infringement. If they put one construction upon it they would say that it was not anticipated, but at the same time it was not infringed; if they put another upon it, then they would say that it was infringed —but that at the same time it was anticipated. He would therefore put his case in an alternative way. If Edison's words were considered in the largest sense that they would bear, he would be anticipated in his patent; if they were restricted to the literal meaning, then there was no invention. If they considered his claim to be as on the face of it, it seemed to be: "I claim an instrument which has these features—a tympan, a tension regulator, such as I have described." Then he did not think that in any strict sense Hunnings' telephone came within the description as contained in the specification. Edison claimed the two things—tympan and tension regulator—in combination as his instrument. Hunnings' instrument had no combination at all, because there was no tympan; and besides, Hunnings' transmitter was not a transmitter as described by Edison, nor was it a transmitter which differed from that only by the substitution of what were known to be equivalents for what Edison put in. He would put it as a point of law that an infringement of a machine to be such must be what was known at the time as an infringement. He would contend in the first place that coke was not an equivalent for Edison's lampblack. But even if it was, it was not known at the time of the alleged infringement that it was an equivalent. If he could prove, and he believed he could, that that was the law of the case, then, without going into the details of the Hunnings, that would settle the question of infringement in the negative. But the two instruments were as distinct as they could possibly be. Edison thought, as everybody did, at the time of taking out his patent, that if they wanted to get a telephone to talk, it was no use asking the sound-waves from the voice directly to do it; but if they could only get them to act on a large tympanum, then the vibrations might make the centre of the tympan move as the resultant of all these voice-waves, and it might be got to press upon anything in contact with it with a vigour which they could not get from the air-waves directly. Edison thought that having got this motion in his tympanum, he might adjust his tension regulator with considerable nicety, so as to get a continuity of pressure between that tympan and the carbon beneath it. This pressure might operate in two ways—by compressing the carbon itself, or by pressing the surfaces in contact together in such a way as to enlarge the area of contact, and so diminish the resistance. He relied upon the supposed fact, too, that a very slight alteration of the pressure in the carbon would produce an enormous change in its conductivity. Sir W. Thomson held by that idea till February of this year, and almost up to the present it was believed to be a quality of carbon. After arguing at some length as to what constituted legal publication of a book with reference to the question of whether a description of Reiss's telephone which appeared in an American periodical, the *Scientific American*, of September 9th, 1876, was published in London by there being two copies of it traced to the Patent Office and the Institute of Civil Engineers respectively, Mr. Hemming said that he would first consider their alleged infringement of Bell's patent. It was said that they had infringed by taking Bell's receiver; it was not said or suggested that they had infringed by taking his entire telephone or anything like it. Their telephone was as different from Bell's as anything could possibly be. What then did Bell's patent claim? If it merely claimed a whole instrument consisting of receiver and transmitter, as an entire combination, then taking the receiver would be no infringement. If it, on the other hand, claimed besides the whole instrument as an entire combination, the receiver and transmitter separately, then making a similar receiver would infringe the patent. Mr. Hemming then analysed the claims of Bell's patent in succession, and contended that claims 5

and 6, concerning the receiver, only spoke of it as part of a complete telephonic apparatus, and that no separate claim was made for a receiver *per se*. The alleged novelties in Bell's patent were two, and two only. One, which Sir W. Thomson called a great discovery, was that he could do without a battery current, and use instead a permanent magnet or a locally-excited magnet; and the other was the use of the iron plate. That was the nature of Bell's invention which they would have to bear in mind in the consideration of this case. Then he came to the question of whether the Bell receiver was not anticipated. And first he would say that it was anticipated by the Reiss receiver No. 2, and by No. 1, though in a more remote way. If publication of No. 2 was not admitted, then he would ask his lordship to apply his observations to No. 1. Mr. Hemming then quoted from the evidence of witnesses bearing on No. 2 Reiss—particularly that of Professor Dolbear, to show that there was a peculiar "bow"-like motion of the armature in it, though Legat did not describe it so, and therefore the instrument could be used in a way that its inventor, its describer, and everybody else had no idea of. It made no difference whether Reiss was ignorant of the particular manner of using this machine or not; the fact of a machine being used in a bad way did not give anyone a right to take out a patent afterwards to use it in a better way, even though the inventor was in perfect ignorance of the proper method of working his own invention. Assume that Reiss did not know that, yet if Bell put Reiss's machine to a previously unknown use, that gave Bell no power to take out a patent for his discovery. After authorities had been quoted for the law on the point, Mr. Justice Fry said that assumed that the Reiss spoke well. He had never heard it do so. Mr. Hemming said that the evidence bore out that the pair of Reiss's instruments spoke, but very imperfectly, because in order to make the transmitter articulate at all, they must speak to it in a low tone, and that impaired the action of the receiver. But he would put the law of the case as wide as this: that whether it was known that Reiss's spoke at all or not, if they could make it speak *now*, even badly, that would be a sufficient anticipation of any patent which claimed an analogous instrument, unless it was claimed as an improvement. No one had a right in law to prevent a workman from using his tools in a most efficient state. As Professor Dolbear had explained the action of the Reiss, the beam was the conductor of the vibrations through the sounding box, and that there was, firstly, a "bow" motion between the different parts of the armature, and also a molecular motion. Both these actions set up the vibrations which passed from the sound box. Both had a share; but Professor Dolbear attributed the greater part of them to the "bow" action. The possession of the screw in Reiss's was commented on at length, Mr. Hemming adducing the testimony of Professor Dolbear and Sir W. Thomson to prove that it should be light in order to the effective working of the instrument. Mr. Justice Fry said that it was very difficult to read Sir W. Thomson's explanation along with that of Legat, and understand it. It was a very remarkable point that no two scientific men seemed to have given the same explanation. Mr. Hemming, continuing, said that the effect of the evidence went clearly to show that the screw was a regulator. It could not regulate without touching, and a touching screw excluded altogether pendulum motion. That was a scientific explanation which commended itself to his mind as the true one. Mr. Justice Fry again raised the question of the speaking powers of the Reiss taken as a whole, of the fact of which he stated that he had no evidence before him. The Reiss receiver had been tried with another transmitter. Mr. Hemming quoted from Professor Sylvanus Thompson to show that he had used the first form of the Reiss successfully with its own receiver and transmitter. "Sometimes I get speech, sometimes imperfect speech, sometimes mere noises"; and the best telephone in the world would give these noises sometimes. If then it was admitted that the Reiss could speak, it was certainly an anticipation of Bell. There was absolutely no difference in the two instruments; the armature was a little wider and the brass beam a little shorter, and instead of being held up by the counteracting influences of the pivot, it was screwed on to the stand. It would therefore act absolutely in the same way as the other if adjusted with the screw screwed up, and every one who had got a Reiss had a right to screw it up. It was absolutely analogous to the Reiss receiver, and yet with that adjustment they would get admirable speech. Sir W. Thomson had explained that with regard to the principle upon which Mr. Edison relied for giving effect to his instrument, and upon which everybody relied at the time, taking it to be an essential thing; *tympanum* had been defined substantially in the same way by all the witnesses. The idea of a tympanum was taken from the tympanum of the ear, as that with which they were most familiar. They had first the ear-tympanum, and then parchment over a drum. If the material was elastic in itself, they did not want to strain it; if it was not, they must put it in a strained condition. There was no difference whatever, according to the evidence, between a tympan formed of a strained bit of parchment and a tympan of an unstrained piece of flaccid material: they both did the same thing—received vibrations. If the tympan was circular, which was the normal form, the vibrations set up a series of circular nodes, and this was utilised as pressure upon the carbon beneath. A diaphragm was simply, as Professor Dolbear had lucidly explained, a separator, or separating film. A tympanum was also a film, but in consequence of its elasticity it could take up vibrations of the air and concentrate them in circular nodes or rippling vibrations. There was a popular use of the words outside the scientific use, and people had got into the way of calling a tympanum a diaphragm; but there was the distinction between them which he had stated. A diaphragm separated something from something; a tympan received and concentrated vibrations. The question, however, really was what Edison meant, and what he did mean by tympan or diaphragm, apart altogether from the strict and proper meaning of the words; and this with the assistance of all the figures which he had given, seemed as plain as possible. All the materials he spoke of as materials that might be used as diaphragms were materials with the same elasticity in them. He used mica, which had the property in a very large degree. The advantage of using a diaphragm in a telephone instrument was that the effect was greatly intensified; only with that advantage they had a disadvantage—the diaphragm strengthens the waves of sound, but at the same time it corrupts them; there was less fidelity, if there was more power. In employing mica, Mr. Edison had groped his way to that principle. Many materials he said had been employed by him, but almost all of them produced a prolonged or secondary vibration—that is, by their resonance the waves were destroyed or corrupted. Almost all materials would take up vibrations more or less, yet they had little tendencies of their own which weakened the fidelity of the reproduction. It had not entered into anybody's mind to suppose that you could, without the additional power which a diaphragm or tympan gave, get a tympanic action. Two or three witnesses had told them very distinctly that when it was first announced that that could be done, they had received it with extreme surprise; they had not thought it possible, and nobody did till Hughes's discovery of the microphone. An analogous discovery was made by Edison and Hunnings about the same time. Just as Bell made the great discovery that he could dispense with the battery power of a line wire, so the experiments made by Hunnings showed that he could dispense with the additional power given by the tympan, which had hitherto been thought an essential part of the instrument. In his disclaimer Edison relinquished all claim to anything except a tension regulator combined in a tympan. Now, this being the case, they could concede every single disputed fact relating to the Edison patent. Admit that Hunnings' coke was the same thing as Edison's lampblack, that the mounting and adjustment of the apparatus was the same in both cases, that the diaphragm acted as a tympanum—then it was his contention that if it was an equivalent of Edison it did not matter, because it was not known to be such at the date of the patent. They had witness after witness saying that at the time the whole scientific world believed that, so far from a machine without a tympanum being effective, it could not work at all. The very idea that Edison made the essence of his telephone was discarded by Mr. Hunnings altogether. Mr. Hemming then cited several cases at length which he contended demonstrated that this principle was the law. He held, therefore, that he was entitled to say that even if, in any fair and reasonable sense, the Hunnings could be treated as an equivalent to Edison, still nobody knew of the principle which Hunnings employed at the date of Edison's patent; and, as any person had a right to use for any machine or process a previously unknown equivalent, they could not be accused of infringing that patent in the legal aspect of the case alone. Proceeding to consider the details of the instrument, Mr. Hemming said that Hunnings' foil was not at all analogous to Edison's. It was not put there as a conductor, because if it had a capacity for vibrations, it was damped. Mr. Justice Fry said that the very fact was the same thing as communicating pressure. He might just as well say that whatever undulations were communicated by the mica to the cork in Edison's instrument was damped in the platinum coil. He thought that certainly they wanted vibrations to be communicated to the coke, and what Mr. Hemming called "damping" was the same thing as communicating these vibrations. Mr. Hemming said that in Edison the vibrations of the tympan were concentrated and communicated to lampblack, but in the Hunnings', where the coke was scattered about below the foil, the mode of vibration in the latter which the Edison would require was utterly interfered with. Of course the coke did the work of the Hunnings, but the arrangement was such that it would not do it in the same way as the tympan. It was as distinct from the action of the tympan as any one thing could possibly be from another. The whole scientific world believed that the action of the tympan, as distinct from the action of the coke, was an absolutely essential ingredient in a telephonic instrument. When Mr. Edison described his machine, and said, "There is my diaphragm, or tympan; there is my tension regulator; the combination of two things is what I claim," you could not possibly say, "That is a claim for one without the other," even if it were true in some sort of feeble sense that Hunnings' foil, though not known to do so at the time, performed a somewhat analogous function to that of a tympan. If a man patented a combination of A and B as the two operations of his machine, and somebody came afterwards and said, "I have found that B alone will do the work," it would not do for the original patentee to say, "I can trace in B some of the qualities of A, and therefore I say that your invention is identical with that combination of A and B for which I took out my patent." Edison had in his original claim diaphragm, mica, electric conductor, foil, cork, and tension regulator. His instrument embraced all these as essential parts, and his specification could only be construed in such a way as to understand *diaphragm* and *tympan* to refer to two distinct and separate things. But all that was assuming that there was no difference between the Edison and the Hunnings. Yet the evidence showed a very wide range of divergence. There was this rejection of the tympan, which took the Hunnings out of the patent entirely. Then, was the material the same? There was nothing like coke mentioned in the Edison. Edison specified many materials, but coke was not one of them. He specified lampblack and plumbago; but the only similarity was between powdered lampblack and granulated coke, which were not the same in any proper sense of the word. The only qualities in common were that coke could enter into combinations identical with some forms of lampblack. One witness considered plumbago to be so distinct in its composition from carbon that he said it was composed of an element, graphon, having the same atomic weight as carbon, but differing in all its essential properties besides. The difference between lampblack and coke was simply enormous. Coke was as much a non-conductor as gutta-percha; at least, it had a thousand times less conductivity than lampblack, which by the impurities that were very often found in it was rendered frequently a comparatively good conductor. An extremely minute quantity of conducting substance would altogether

change the resistance of a substance which, without it, would be a non-conductor. Many experiments with the best, *i.e.*, the purest lampblack had failed, as several witnesses had told them, and doubtless simply upon that account. They had had no account of the manufacture of the Edison lampblack buttons, which certainly worked very effectively, and he believed that there was an admixture of some impurity in them. Edison had insisted upon the necessity of a poor conductor, such as lampblack, but the only objection to a good conductor, such as metal in the Hunnings, was that it fused at a comparatively low point, and so broke circuit. It was simply the accident of a low fusing point that prevented their using even such a metal as silver. The mechanism of the two instruments was another point of difference. The whole principle of Edison's was a nicely-adjusted pressure, so that there might be uniformable action between his tympanum and his tension regulator; in the Hunnings, on the other hand, they desired to get rid of pressure as much as possible. Hunnings' bit of foil was simply a conductor and a container; it had no tympanum action in the sense which was necessary to Edison's machine. Passing from the question of differences, Mr. Hemming next argued the strictly legal point, supporting his view by a wide citation of authorities, that Edison's claim was void in that he attempted to claim mica as a special tympan, and when a whole choice of materials was open no man had a right to set up a claim to any particular one exclusively. As to Mr. Edison's phonograph, the claim for it in the complete specification was not covered by anything in the provisional, seeing that the latter only claimed for electrical transmission of sound. In concluding his speech, Mr. Hemming quoted from Lord MacLaren's judgment in the Scotch trial, in which—though there were hardly any important facts proved then that were not disproved in London—he thought a great body of evidence went in their favour. Lord MacLaren's opinion was already on their side in regard to Sir W. Thomson's description of the Glasgow receiver as having been a sufficient disclosure to invalidate a subsequent patent.

Speech of Mr. ASTON.

Mr. Aston, Q.C., in opening his speech for the plaintiff, said he should ask his lordship to consider whether the Bell patent was a good patent; firstly, having regard to the alleged anticipations, and secondly, having regard to the objections raised against the specification. The alleged anticipations were practically two in number—the prior publication of something written or published by Reiss, and the publication of something said or done by Sir W. Thomson at Glasgow. He was going to address himself entirely to the question of a receiving instrument, because the whole case turned on the question of whether or not there was a publication of a receiver having a plate armature prior to December, 1876. If such publication could be proved, the patent could not be supported. He would ask his lordship to endeavour as much as possible to strip his mind of all information now possessed and endeavour, in dealing with the whole matter, to put himself in exactly the position which he must have occupied in 1876. Mr. Justice Fry said that if Mr. Aston claimed clearly and distinctly a receiver with plate armature, that claim was embarrassed by so many conditions that it was not a very easy thing to do. Mr. Aston said that he did so claim; Bell claimed *qua* receiver in his specification. The figure by which he took his stand was A3, which dominated the whole of Bell's specification in every figure and every description, and the armature there was a plated armature. Prior to the first publication of Bell's discovery in Philadelphia nobody had ever attempted to reproduce telephonically either speech or musical notes otherwise than by an intermittent current and a "tongue" vibrator, not even excepting Reiss. Consequently those who heard Sir W. Thomson's description of the Glasgow instrument were prepared for a tongued vibrator, and not for a free reed. In the light of that general statement he was going to take exception to the later reading of Reiss, and to ask his lordship to accept the former reading of the Reiss description, which even his learned friend Mr. Hemming admitted was the reading which he himself accepted up to the time of Professor Dolbear entering the witness-box. Coming then to the alleged anticipation by publication he would rely on the description contained in the *Zeitschrift*, but he would argue in the first place that the *Zeitschrift* never was published so as to come within a proper definition of the term. Mr. Aston then dwelt at great length on the legal definition of publication. The book was in a foreign language, it had never been exposed for sale, and only two copies could be traced to England; on all these grounds he held that the authorities justified him in saying that the *Zeitschrift* did not add to the amount of the public knowledge. But he had a better answer to Reiss than that of non-publication. He should ask his lordship to read the description as it had been read by Professor Barrett in the light of his own article in *Good Words*, as Sir W. Thomson read it in his own book, as Prof. Dolbear read it until he tried to find in it a more favourable construction for the view he was advocating. He submitted with the utmost confidence that the bar which ought to act pendulum-wise if used as Reiss intended it to be used, and as all these witnesses interpreted its use, was in no sense a plate armature, and therefore no anticipation of Bell's. A prior publication must, in order to be an anticipation, contain a description of what was essential to the invention, and as the plate armature was essential in Bell, the *Zeitschrift* had no legal force in anticipating it. Mr. Aston then entered into a minute and detailed examination of the two instruments, insisting particularly on the fundamental distinction between the bar acting pendulum-wise in the one and the plate armature in the other, and analysing the evidence at great length, especially on the question of the mode of vibration, which he contended upheld his distinction. If fairly used in the way which the maker intended it should be used, Reiss's instrument remained a vibrating instrument used with intermittent currents—capable, indeed, of giving articulate sounds when these were combined with musical notes; but incapable of doing that which the other side had said they could make it do, but had never done—of speaking articulately. It was no use for witness after witness to come into court and say that they heard the thing speak. It entirely depended on what they called speaking. He had himself heard the Glasgow receiver speak. He heard it say 1, 2, 3, 4, but he never heard articulate speech of certainty—nothing at all approaching what they could get from a Bell receiver and transmitter, nor from an Edison transmitter and Cox-Walker receiver, nor from a Hunnings receiver, or, to call it by its right name, a Bell receiver. He would therefore ask his lordship to look upon the Reiss as an instrument operating—whatever it might do now under the light of the discoveries of the last few years—according to the idea of its inventor, on a totally dissimilar principle to that of Bell. He had, besides, great difficulty even now, after all the explanation he had heard, in understanding Legat's paper, and therefore he submitted that that description was too vague and unsatisfactory, apart altogether from the principle of the instrument, to constitute an anticipation. Take Reiss's receiver, and instead of the crossbar which he used pendulum-wise, let them make it a fixture, using screws to join it hard up, so as to prevent the bar touching the core; let them do away with the spring action, and they would have a quasi vibrating plate. But what had they done? They had taken the cue from the plaintiff's patent. They must take the prior clumsy machine as it stands. Don't alter its screws, or do away with its springs, or jamb the bar hard up, because they were then importing into Reiss something which Reiss never contemplated—using it, in fact, in a way which had been never thought of till Professor Dolbear stepped into the box. He submitted that a clumsy machine could not legally be converted into an effective one and still retain its original patent rights; and therefore they must take Reiss as they found him as the standard to go by. After quoting precedents in support of this contention, Mr. Aston proceeded to the question of the Glasgow receiver, and contended that the tilted plate in it was intended to be brought into position by magnetic action. When Sir W. Thomson heard the instrument at Philadelphia, he heard directions given to put on and take off battery power, and he could not help thinking that what Bell was then trying to do was to neutralise the resiliency of the plate by increased battery power. Bell did, doubtless, discover that he must have an inert and passive plate, not merely brought down flat by the magnetic attraction; but he did not think that, according to the evidence, Sir W. Thomson's exhibit at Glasgow was an instrument of that description, and, being so, it was no anticipation of the subsequent patent. That fact might account for the failure of the Glasgow receiver in Sir W. Thomson's hands: he might not have sufficient battery power to counteract the resiliency of the plate, and bring it into a condition of being perfectly inert and passive. Mr. Justice Fry thought that the statement in the description of the armature "screwed at its edge to the outer casing, and touching it at no other point," seemed to go against Mr. Aston's view. Mr. Aston said his reading was—"touching at no other spot except where it was screwed." He did not think that the used spot could be interpreted to mean the periphery of the edge. At all events, it was in his favour that they had the identical instrument in court which was intended to be described, and it is in just the tilted condition that THE TELEGRAPHIC JOURNAL described it as being when shown to the Glasgow audience. Mr. Dunscombe's instrument, made from Prof. Sylvanus Thompson's drawing, had also the tilt, which he said he purposely put there to match his instructions. That then was a vital difference, and, as it was practically useless, he would hold that it was a "blundering instrument which was no anticipation." When used in court, even prepared by the other side with an exceptional transmitter, and actually a sevenfold Hunnings, there was no successful articulation. There was no question about the tilted disc; not one witness had come forward and said, "I saw the Glasgow instrument, and I describe it as a flat disc." If it was tilted he would take his stand by A3, the flat inert plate, and that diagram was perfectly sufficient to destroy the claim of anticipation. The Glasgow tilted plate receiver with uncertain action could not possibly be an anticipation of Bell's flat plate receiver with certain action. Mr. Aston then analysed the evidence in detail of Sir William Thomson, Dr. Hopkinson, Mr. Imray, Dr. Muirhead, Professor Barrett, to prove the condition of the instrument, the want of a distinct understanding of its mode of operation, the limited publicity obtained by it, and its failure to produce articulate speech. This instrument had failed in court with all the advantageous conditions secured by those interested in its success to do anything beyond articulating indistinctly for a short period. If it could have been got to speak continuously by any means, these would have been tried; yet it was a total failure, and must be relegated to the limbo of incomplete experimental apparatus. There was nothing to show that the public, from the inspection of the instrument, could have done better than what had been done with it here; and its tilted plate was a vital differentia on the question of anticipation, for even Professor Sylvanus Thompson had admitted that the more passive and inert the plate was made, the more perfectly would you make it articulate.

Dealing next with the question of the objections raised against the specification, Mr. Aston dealt first with the point in which it was said that Prof. Bell's claim was anticipated by Faraday. There were four points of correspondence which were required to exist: a correspondence between the original vibrations of the air and the diaphragm; a correspondence between the diaphragm and the undulatory current; correspondence between the undulatory current and the receiving magnet; and a correspondence between the magnet and the plate which was to reproduce the vibrations of the air. The objection was that the idea of the correspondence between the magnet and the undulatory current was Faraday's. But their real claim was the combination of that correspondence between magnet and current with the correspondence between the diaphragm and the magnet, and this same question appeared in another form in the case, and might be taken to stand or fall by the same general principle. He was confident, however, that since their claim was only with the combination, the fact of Faraday having discovered one of the component ideas singly did not affect their patent.

Coming then to the second point with which he proposed to deal—Was Edison's a good patent? and had it been infringed? His learned friend had put the first question in two ways—If Edison s specification was strictly construed, there was no infringment; if Edison's specification was taken in its widest construction, there was no novelty. That was not the first time that alternatives had been put before the court, and he must meet it in two ways. He would ask his lordship to hold that that was the true construction of the specification which he ventured to place before the court. What was Edison's invention? It was an invention which consisted in making the vibrations of the atmosphere resulting from the human voice act in increasing or lessening the electric force on a line in an electric current, by increasing or lessening the intimacy of contact between conducting surfaces placed in the line. In my present invention, he says, I make use of the vibrations coming to the diaphragm, or tympan, by speaking into a resonant case to produce a rise and fall of electric tension upon the line with which, by the means hereafter described, electric pulsations, or waves, are made to reproduce the atmospheric sounds and waves. That was absolutely new at the date of his patent. There was not a tittle of evidence that that had ever been done before Edison's patent. Then he went on to describe the necessity of a tension regulator, and to describe his materials and mode of preparing these for such tension regulators. Five or six classes of tension regulators were figured; a fibre regulator, plumbago disc, lampblack in case, platinum foil disc, and disc and spring. These were all distinct varieties, and he thought he could show that Hunnings' coke regulator was like two of them—the plumbago and lampblack—though of course it was more or less like all the others too. Certain general properties belonged to the materials which Edison employed as regulators; they must have been conducting materials susceptible to pressure, and capable of recuperation, and of showing that in proportion to the pressure employed in a varying extent of "surface of pressure that is to be affected by the sound waves." Mr. Edison could have claimed the use of one particular tension regulator *per se*—but he did not do so—but claiming all these classes of regulator by general description, he submitted that he was perfectly within his rights as a patentee. After arguing this principle at length, Mr. Aston proceeded to compare the Hunnings and the Edison part by part, dwelling particularly on the perfectly analogous and identical use of the diaphragm in both, and on the identity subsisting between the coke of the former, and the lampblack of the latter. Speaking of the relative efficiency of the two instruments, Mr. Aston said that it was all very well for gentlemen to come there and talk about carbonaceous matter enclosed in a bag being made to repeat articulate sounds. That did not affect him. He was all through talking of such a transmitter as a merchant would buy, and royalty would be paid for, that could be used without any particular adjustment at the moment. When he listened to Hunnings in court, he heard distinctly for a short time, then the articulations were dulled; immediately he heard the finger of the operator loosening the mass of coke, and the sound became brighter again. That was an instrument that would never do for commercial purposes. The question of infringment by Hunnings might be put in a very simple form. They had an expanded electrode in the Edison, and the question was, Was Hunnings' narrow strip identical in nature and function? He contended that it was. Mr. Aston then reviewed and read extensively from the scientific evidence before the court to prove that Hunnings' tinfoil had all the properties of Edison's diaphragm, after which Mr. Hemming's citations of authorities on behalf of his contention for the invalidity of Edison's patent were examined in succession, and the attempt made to multiply their force by either denying their applicability, disputing their reading, or confronting them with contrary decisions. He proceeded:—His friends said that Edison's specification was bad, because it claimed a mica diaphragm in its first claiming clause, and the phonograph in the third. He was going to ask his lordship to read the phrase substantially as set forth in that clause as governing the whole clause. The construction ought always to be taken which makes the meaning reasonable and sensible rather than utterly absurd. In an instrument for transmitting electrical impulses by sound, as described, a diaphragm or tympan of mica is substantially set forth. He would ask his lordship to read the last clause first, as governing the whole as the only reasonable mode of construction. Edison really claims the mica in all those instruments where electrical impulses by sound are transmitted. It was not mica generally that he claimed as a diaphragm; only in such instruments. He thought that reading would commend itself to his lordship, because in all cases the use he made of his mica was to form a diaphragm, and therefore it was a limitation of the latter word, and therefore the only reasonable view to take of its use in the sentence. The presumption in law was that where there were two constructions, one of which would support the patent, and another which would introduce a difficulty, the former in all cases should be taken.

With regard to the claim made in the provisional specification for the recording the undulations and the reproduction of sound, the only ground on which that could not be supported was what was called disconformity. The statute provided that the provisional specification should be referred to the law officer, and if he was satisfied that the description was a fair one it passed his hands and was good in law. Letters-patent were granted for what was the subject of the application, and in order to show that a comparison was made between the provisional and the complete specifications; but in all cases the nature of the invention must be indicated. He contended that these conditions had been clearly met as regards Edison's claim. His invention was fairly under the title of his provisional specification. The phonograph, he argued, was able to perform three functions—to transmit, record, and re-transmit. Two of these were admitted by Mr. Hemming, and he held that in law the question of re-transmission was distinctly covered by the title. Upon the whole case he submitted that there had been no anticipation either by the German work or by the Glasgow receiver. It was clear beyond all question that there was no defect in Bell's specification, and it was clear beyond all question that the defendant by using the receiver which he had, had infringed Bell's patent. Upon that patent, therefore, he would ask his lordship to give injunction as asked for. The Edison part of the case had been put on two grounds—no infringement and invalid patent. It had not been stated or alleged that any description was ever given of the tension regulator such as Edison described it in his specification. As regards novelty, therefore, there appeared to be, even according to the case made out by the defendants themselves and from their own witnesses, that there was nothing to impeach Edison's invention. He hoped he had placed before his lordship a reading of the specification which would commend itself to him, and therefore on both grounds he looked with confidence for the granting by his lordship of the injunction asked.

JUDGMENT DELIVERED MAY 19TH, 1882.

MR. JUSTICE FRY said: In this case the evidence on both sides has been of great extent and interest. The instruments which are in controversy are of the highest ingenuity and value, and the questions that demand decision are of considerable perplexity and delicacy. The plaintiff sues on two patents—the first, which I shall refer to as Bell's patent, was granted on the 9th December, 1876; the second, which will be referred to as the Edison patent, was granted on the 30th July, 1877. The defendants have, as is admitted, made and sold three instruments, which are in question— 1st, a receiver known as the Cox-Walker receiver, which is alleged by the plaintiffs to be an infringement of Bell's patent; 2nd, another receiver, the Hickley's, likewise alleged to be an infringement of Bell's patent; and 3rd, a transmitter known as the Hunnings', said to be an evasion of the Edison patent. Long before the year 1876, in fact about 50 years ago, discoveries had been made by Faraday in electricity and the connected sciences, which undoubtedly lie at the bottom of the present inventions. The substance of those discoveries I take to be fairly stated in the specification to Bell's patent when he says: "It has long been known that when a permanent magnet is caused to approach the pole of an electro-magnet a current of electricity is induced in the coils of the latter, and that when it is made to recede a current of opposite polarity to the first appears upon the wire. When, therefore, a permanent magnet is caused to vibrate in front of the pole of an electro-magnet, an undulatory current of electricity is induced in the coils of the electro-magnet, the undulations of which correspond in rapidity of succession to the vibrations of the magnet, in polarity to the direction of its motion, and in intensity to the amplitude of its vibration, or rather to the velocity of its motion." This invention of Faraday's was one of the most pregnant of modern discoveries. It had long been known that a vibrating metal tongue or reed could be used to make and break the contact of a galvanic circuit, and thus produce intermittency in the current; and that similar vibrations could be, by the successive presence and absence of the magnetic attraction, reproduced in another metal tongue or free reed; and the idea soon suggested itself that, if the first tongue were so vibrated as to produce sonorous undulations, similar results could be produced at distant places wherever the current was carried. This was the principle of the musical telephones which existed before 1876, and which in certain cases were found, occasionally and with uncertainty, to reproduce vocal sounds of musical and especially vowel sounds. The German inventor, Reiss, had gone a step further, and used a membrane to set a piece of metal in motion; but, according to the evidence before me, it is clear that, before Bell's discovery, there was no practical and trustworthy mode of transmitting articulate sounds to a distance by means of electricity. Mr. Bell appears to me to have seized three ideas. In the first place, he distinctly perceived that, whilst for musical notes the tongue or free reed might act both as transmitter and receiver, for the human voice you must apply an extended and elastic surface, such as a disc of metal with a membrane extended and attached to a circumference, after the fashion of the drum of the human ear; and secondly, that, whilst for musical notes intermittent currents might be used, the undulations of the human voice could be communicated only by continuous undulatory currents; thirdly, that it is not necessary for the purpose of communicating the human voice to use a battery current, but that an undulatory current adequate to this purpose may be produced by placing two permanent magnets surrounded by coils, one in the transmitter and the other in the receiver, and operating on one of these by the vibrations of a plate of inductive properties placed within the magnetic field. This vibratory action of the plate produces the undulatory current, which operates through the permanent magnet of a receiver on another plate of inductive properties placed within its field. In 1876 Mr. Bell had made an instrument which, in the first place, appears to have had a transmitter and receiver of the same character, each of those instruments consisting of a tympan or drum of membrane, which tympan or drum carried a piece of iron or an armature capable of producing inductive action. The receiver appears to have been constituted in the same way, and he appears in the first place to have used an instrument of that construction. But in August, 1876, at the Philadelphia Exhibition, he exhibited an instrument made after a somewhat different fashion, in that the transmitter consisted of a membrane charged with an armature or steel spring, while the receiver was an annular magnet furnished with a flat plate, the external portion—the annulus, in fact, of the magnet—being one of the poles, and the central core the other pole. It appears to me to be clear, as exhibited at Philadelphia, that the armature was not attached in any way to the body of the receiver, but that it was held down by the force of the galvanic current which passed through that receiver. Sir W. Thomson visited that exhibition, and naturally attended with the utmost interest to the instrument there exhibited by Mr. Bell. It appears to have answered to a certain extent in Sir William's presence, and he undoubtedly heard words brought from a distant room to the receiver. The discovery was one of the greatest interest to him, and when he was leaving Boston Mr. Bell placed in his hands a brown-paper parcel, which contained a

transmitter and a receiver, which had been produced in court, and which had been the subject of a vast amount of discussion. When Sir W. Thomson opened the parcel he found that the armature of the receiver was attached to the annulus of the magnet by a screw, and, according to the conclusion which I arrive at on the evidence, he found the armature tilted at a certain angle from the plane of the top of the receiver. Sir W. Thomson brought these instruments with him to this country, and, at the meeting of the British Association, which took place in September of that year at Glasgow, he exhibited those instruments, and made them the subject of a portion of his address as the Vice-President of one of the sections. The words of his discourse have been in evidence before me; they contain a statement of the results which have been arrived at by Mr. Graham Bell, but do not in my judgment communicate to the public the exact method by which those results were arrived at. It will be necessary for me hereafter, in considering the objections made to the patent, to consider more in detail the fact of Sir W. Thomson's exhibition of these instruments in Glasgow. I mention them now merely as part of the narrative of the case. On December 9th, 1876, the letters-patent which are first in question were granted to Mr. Morgan Brown, on the communication made by Mr. Bell to him, and they were the subject of a disclaimer and memorandum of alteration which was filed, I think, on 13th February, 1878. The specification as originally filed contained five or six distinct plans of operation. With regard to the first three it is not necessary for me now to say more than to observe that they related to what has been called multifold telegraphy, and that they provided for the transmission of several currents along one wire or system of wires. They are not retained in the disclaimed patent except so far as they are necessary to the explanation of the fourth and fifth plans there contained. The fourth plan provides for the transmission of the human voice, by means of a continuous voltaic current; it provides for a transmitter with a membranous tympan, and a conducting armature; it provides for a similar receiver, and it also adds as an alternative plan the use of metal plates, or other inductive substances. The fifth plan is founded on the discovery which I have already mentioned as made by Mr. Bell; in it the battery is omitted, and the permanent magnets are substituted for the electro-magnets in the last plan, and the current produced by the vibrations is not superimposed upon a voltaic current, but is itself used to create corresponding vibrations in the receiver. A subordinate feature is also described, which is really a description only of an electric equivalent. It is impossible to doubt the beauty or the value or the ingenuity of the discovery that had been so made by Mr. Bell; he had solved one of the most difficult problems of physics, one which undoubtedly had been attracting the attention of men of science for many years past. It was, however, found that the membrane used in the tympanum was not entirely successful. That membrane had, as I have already observed, attached to it as an armature, a piece of steel wire, and the presence of that weight at a particular part of the tympan seems, according to the evidence before me, to have had some disturbing influence upon the action of the tympan itself. Furthermore, the membrane is liable to be influenced by changes of atmosphere and by the difference of moisture in the atmosphere; and as the receiver might be at a considerable distance from the transmitter, it is obvious that different atmospheric influences might operate on the two instruments, and therefore place them, not in harmony but in discord. These difficulties in the way of the use of the membrane induced Mr. Bell, in memoranda of alterations, to point out that a great improvement had to be introduced into the instrument, by substituting for the membranous tympan a metal plate or disc, which of course was inductive in its own nature, and was free from the objections which were found to obtain in the case of the membrane. That as a whole the instrument disclosed by the letters-patent was new appears to me not to be doubted. What had been done only occasionally and badly by such instruments as those of Reiss, which had happened to communicate speech by intermittent currents; what Sir W. Thomson could not do with the Glasgow transmitter and receiver (because he had been unable to show the British Association at Glasgow that it could work); what Dr. Muirhead could not do in his attempt to copy Sir William's instrument—that could be done as soon as the complete specification was made known. That the Glasgow instrument, taken as a whole, was incapable of producing this satisfactory result is proved to me by the fact that it failed in the hands of perhaps the most skilled person in the world to deal with such an instrument—Sir W. Thomson himself. It remains, however, to inquire whether the other instrument alone is claimed, and if not what parts were claimed, and whether the parts so claimed were new, and whether the invention had been infringed by the defendants. The defendants had used and sold instruments known as the Cox-Walker and Hickley receivers, and no argument has been addressed to me to show that they are not in substance the same as the Bell receiver; but the difficulty which the defendants present to the plaintiffs' case takes the form of an alternative argument. If, say the defendants, you claim only the receiver in combination with a transmitter like Bell's, we have not infringed, for we have never used such a receiver; if, on the other hand, you claim the Bell receiver as a substantive and independent invention, then it is not a new one. There is no evidence of the use of the Cox-Walker or Hickley receiver with an instrument like the Bell transmitter, and in fact it does not appear to have been so used. That Bell's specification claims the receiver he there describes as a substantive invention is the common case both of plaintiffs and defendants, and is also in accordance with my own construction of the specification. Has Bell's receiver then been anticipated by previous inventions or by public knowledge? Before considering the anticipations, I think it expedient to describe Bell's receiver as claimed by him and as I understand it. It consists of a horse-shoe magnet, the ends of which are brought into the circuit by means of coils of wire, and in front of which is a metallic plate capable of inductive action, placed at right angles to the length of the magnet, resting as regards its circumference on the wooden case, the vibrations in which plate are the source of the sound in the receiver. In Bell's invention the receiving and transmitting instruments are interchangeable, and the fourth and fifth plans both in my judgment describe an apparatus in which there are such instruments as I have described used for both purposes. The anticipations relied on are the first and second instruments made by Reiss, and the publication of Bell's own plans through Sir W. Thomson. With regard to the instrument which has been called the first Reiss, it appears to me to be made out plainly that it was known in this country before the patent was taken out, but there is no pretence of a plate armature being used in that instrument. It depends for its operation on the repeated make-and-break of the currents and upon the fact that the rod of iron included in the coil of the receiver gives a distinct tick each time it is de-magnetised, the repetition of which ticks is made to produce vocal sound. The essential parts of the Bell's receiver, therefore, it appears to me are not in any way to be found in the receiver of the first Reiss. As to the second Reiss, which is the instrument described in Legat's paper in the *Zeitschrift*, two questions arise, and the first is, Was it so published as to be part of the public knowledge on this subject before the taking out of Bell's patent? The only book in which an account of this is said to have been published is the *Zeitschrift*, which is of course in the German language. It contains, however, two plates, the one describing the transmitter and the other the receiver, and I think it would be difficult for a person looking at these plates and having any knowledge of magnetic or electric science not to come with tolerable clearness to some conclusion as to what the object of the instrument was. It appears that the book was deposited in the usual manner in the library of the Patent Offices and also in the library of the Institute of Civil Engineers. But in the latter case it was catalogued as a journal; and somewhat strangely, as it appears to me, was not catalogued either under the head electricity or magnetism or any kindred subject. But it is to be borne in mind that this paper is not to be found in some scientific journal mixed up with other papers on other subjects, but is in the journal of a society devoted to telegraphic purposes, the existence of which I should think could hardly be unknown to persons skilled in such matters in this country, and where, it seems to me, very natural that anybody would search for information, as in fact Dr. Muirhead did search and to some extent found it. It is true that the only person who is shown to have consulted it in this country is Dr. Muirhead, who, though unable to read German, was enabled by his knowledge of the technical terms to spell out some information from the paper. Upon the whole, though not without some doubt, I have come to the conclusion that there is evidence before me upon which I infer that the communication made by Legat in that journal must be considered to have been within the knowledge of persons skilled in these matters in this country. It appears to me that this is a fair inference from the facts proved before me. I need not say that in coming to that conclusion I have endeavoured to attend to all the earlier decisions, especially the decisions of the Court of Appeal upon the patent skate case, and I think that the conclusion which I have already expressed is consonant with these decisions, but I am bound to admit that different minds might, as a matter of fact, come to different conclusions on the matter. Assuming this, that the second Reiss, as described by Legat, was a matter of public knowledge, it remains to be considered, further, whether the instrument there described was in anticipation of Mr. Bell's receiver. In my judgment it was not. Looking at the dates it appears to me to be plain that the armature in Reiss's receiver was not a disc at all, it was not a plate at all, but it was a beam, a solid bar. I do not mean that it was rectangular. It appears to me to have been a bar whose section was oval, and that is the result which is conveyed to my mind by the plate; and I think that the model which has been exhibited before me, in which that bar is converted into a twisted or curved disc, does not truly represent the instrument as described by Reiss. I think, therefore, that the criticisms of Sir William Frederick Bramwell on the model were perfectly well founded, and that there was nothing in the Reiss which can be considered to have been an anticipation of the armature of the description indicated in Bell's patent. No doubt Reiss's invention is coming near to the invention which was afterwards made by Mr. Bell; but it does not appear to me to be the same, and I am not at all convinced that it operated in the same way. It is perfectly true that there is some evidence before me that Reiss's instrument will speak. But it does not appear to me that there is any evidence which shows that it could be made successfully to speak before Mr. Bell's patent was made known. And it is obvious that the advances which have been made in telephonic science, very largely in consequence of his discoveries, have enabled persons to use instruments in a manner in which neither their inventors nor their users could have used them before their discovery. And I think this must be further borne in mind, that instruments as little like the true Reiss's are the ones to have been exhibited; and I have no doubt apply within the description of Reiss's instrument as being universal instruments. I next approach the inquiry whether by the disclosure which was made through Sir William Thomson, and through the various papers which copied or examined this instrument before December, 1876, the Glasgow receiver made the principle of Bell's receiver a portion of the public knowledge. As I have already-mentioned, Sir William Thomson explained during his discourse at Glasgow both the transmitter and the receiver were in action. They do not appear to have been connected, and no experiment was or could be performed at the time by Sir William Thomson to explain their action, because he had attempted to make them speak and he had failed. Both instruments were on exhibition for some time afterwards, at first, apparently, in the room in which the lecture had been delivered, and at a subsequent date in the laboratory of the Glasgow University, which was opened to everybody interested in the subject; and there is evidence before me from which one would infer that they were the objects of continual curiosity to persons interested in this kind of discovery. Professor Barrett saw them

there, and made a drawing which he exhibited to his class; and Dr. Muirhead made a rough sketch. The announcement of Sir William Thomson was communicated to Mr. Ayrton, who at that time was thousands of miles away, and a description of it appeared in THE TELEGRAPHIC JOURNAL of October, 1876. That the Glasgow receiver can now be made to speak, though not very distinctly, I know from what has taken place in this court, because I have heard it; but I do not forget that the utterances which I heard were the result of applying to this receiver a great amount of galvanic energy, and a transmitter which was of a perfectly exceptional character—a Hunnings, furnished with seven separate cells. Further, I have no evidence that anybody made the Glasgow receiver speak before the publication of Bell's invention. There is no doubt that as exhibited at Glasgow the armature was fitted on by a screw, and with a tilt; and there can also be no doubt that some of the most competent and skilled persons who saw it came to the conclusion that the disc was intended to be screwed, and that the tilt was part of the design and intended structure of the instrument; and that is not wonderful when one bears in mind the fact that down to this time almost all the experiments which had been made, or instruments which had been formed for the purpose of transmitting speech, had used the instrument in the form of a free reed or tongue, and that this disc, so fastened on, had therefore the position of a free reed or tongue. It might be operated upon by the galvanic attraction of the receiver. There were others who saw the instrument, and who came to the opposite conclusion. But I have before me evidence which shows that Mr. Dunscombe, who was instructed to make a copy of it from a photograph or from an engraving published of the Glasgow receiver, made it purposely with a tilt. In this conflict of evidence I have come to the conclusion that it was far from plain that the tilt of the disc was not an intentional part of the structure. The effect of this tilt on the action of the disc is great. It makes it act as to its vibrations partly as a tympanum and partly as a free reed. As the armature appeared at Glasgow it was intermediate between the old form of armature, the free reed, and the latter form of Bell's, in which the flat disc was used. The Glasgow instrument differed in other particulars from the Bell receiver. In the latter the magnet was wholly within the case, and the circumference of the disc rested on the wood and was held down by the wood. In the Glasgow receiver the magnet was annular, the circumference of the instrument being one pole and the interior core the other. And the disc, when held down at all, was held down by the magnetic attraction. This requires, I think, a much greater exertion of galvanic force than the mere adoption of a disc mechanically kept in front of the magnet. The Bell receiver is also capable of being used as a transmitter, a quality which does not belong to the Glasgow receiver. These differences may appear to be small, but small diversities in delicate matters often make the whole difference between success and failure; and in the present case I have the distinct testimony of Sir Wm. Thomson and others that the Bell is superior to the Glasgow receiver; and many experiments with the Glasgow receiver, even under most favourable circumstances, led me to the same conclusion. I do not forget Professor Sylvanus Thompson's Bristol receiver. I did not at first hear well through it, but subsequently I heard better; but I think that that has been worked with a less tilt than originally made, or than the Glasgow receiver possessed: and, with the whole light cast upon the best mode of using it by discoveries subsequent to 1876, that instrument, I may observe, was only made in the beginning of the present year. With the single exception of this Bristol receiver, and another instrument similar in form but having a thinner armature, and a rough and unsuccessful copy of the Glasgow receiver attempted by Dr. Muirhead, I find no case of the Glasgow form of receiver ever having been used. The burden being on the defendants to show that the anticipation of the Bell receiver by the Glasgow was an instrument practically as good as the patented one, and of an invention which had passed beyond the stage of mere experiment, I think that they fail in discharging that burden. There remain two other objections to be considered, the first of which depends on the first claim made in the specification as amended by the disclaimer. This claim is said to be a claim to undulatory current pure and simple, *i.e.*, to the combination of a vibrating magnet with a current, all of which was well known to Faraday. To accomplish Mr. Bell's object, four points of correspondence or identity are necessary. In the first place, the vibrations of the transmitting magnet must correspond to the vibrations of the voice; in the second place, the undulations of the electric current must correspond to the vibrations of the transmitting magnet; in the third place, the vibrations of the receiving magnet must correspond with the undulations of the current; and in the fourth place, the audible vibrations in the air must correspond with the vibrations of the receiving magnet. If all these correspond, the desired result is produced. Mr. Bell's real stages were the first and the last, the bringing together of the vibrations of the air and of the two magnets at the two ends of the operation, the unification, so to speak, of the diaphragm and of the magnets; but the first claim, so runs the argument, is to the correspondence of the vibrations of the transmitting magnet with the undulations of the current—a thing as old as Faraday, and hence the patent is void. But the patentee himself has shown his consciousness of what his old knowledge was, and he explains, as it seems to me, with reasonable clearness that the correspondence between the vibrations of the magnet and the undulations of the current was a thing well known. To read the first claim therefore as due to Faraday's invention would be to make the document inconsistent with itself, and I think that the words "substantially as set forth" in the fourth and fifth plans introduced into this claim must be taken to confine the claim to the application of Faraday's principles to cases where the magnet or inductive substance is itself agitated by the voice. I have already expressed my opinion that Mr. Bell was the author of a very remarkable discovery; I think further that he has endeavoured to honestly describe that discovery in his specification; and when these two things are found I think it is the duty of a judge to give wide interpretation to the words of the document. Lastly, it is objected that by his original specification Mr. Bell claimed to use for his disc or plate either membrane, or steel, or any inductive substance, and that by his disclaimer and memorandum of amendment he finds steel to be preferable, and claims not any inductive substance, but any equivalent plate capable of inductive action. I am unable to see in this change anything that can affect the validity of the patent. The description of the subject matter of the plate is adequate; the plate described must be inductive and equivalent to a steel plate as regards its capacity to vibrate with the voice. When these qualities are found it seems to come within the description contained in the amended specification. These being the objections made to Bell's patent they all in my opinion fail, and I think that, therefore, the plaintiffs are entitled to an injunction to restrain the sale of the two receivers which are alleged to be violations and infringements of that patent.

I now approach the second part of the case, which deals with Mr. Edison's patent. If a portion of the circuit consists of a substance the parts of which are capable of being brought near to one another by pressure, the effect of the pressure will be that the resistance of the circuit will be diminished and the current will be increased. The most important part of Mr. Edison's invention consists in using the principle to produce undulations of the voice by means of a plate actuated by the voice, and causing pressure on the circuit, and according to the view of the plaintiff's witnesses, and of Professor Dolbear, it is requisite for the practical success of this plan that there should be a material of a low conductivity. It is further requisite that it should possess either in itself or in the supporting mechanism sufficient resiliency to revert to the condition in which it existed before the pressure was exerted. This device was called by Mr. Edison a tension regulator. The principle involved was not new—the law that a current of a given battery varied inversely with the sum of the resistance of the circuit was old and familiar to electricians, and the fact that resistance in certain cases was capable of being diminished by pressure was known, as regards certain materials, though the effect of pressure on the resistance of metals and other substances was at the date of the patent an obscure subject, and appears to be still far from being cleared up. Whenever the metallic point had constituted part of a circuit, and had been subject to any pressure—inasmuch as all metals have some elasticity—there had been in theory a tension regulator, because the resistance lessened as the faces of the metal points broadened. Such a regulator as Edison invented has been discovered in Reiss's instrument. Again, in Clerac's tube, carbon in some form or other had been subjected to pressure in order to lessen the resistance to the current, but there the result was produced by screws, and was not varied automatically in proportion to any other force. In Bell's patent of 1876, the production of electrical undulations by alternately increasing and diminishing the resistance of a circuit had been explained, but the mode of use had the electrodes in water, and its action was limited to a certain extent by the generation of gases from the electrical decomposition of the water. Another similar invention appears to have been made by Mr. Gray, but its precise nature has not been disclosed to me, and nothing has been produced to affect my conclusion that Edison, by putting a plate, actuated by the human voice on a substance capable of having its resistance diminished by compression and requiring resiliency, had made a novel and brilliant discovery. Mr. Edison's patent bears date 30th July, 1877; the specification was filed 30th January in the following year, 1878. Two disclaimers and memoranda of alterations had been filed on 10th February, 1880, and 13th June, 1881, and by those memoranda great alterations had been made in Edison's original claim.

It now becomes necessary to consider the specification of Mr. Edison, and the question which is so closely connected with it as to whether the Hunnings transmitter is an infringement of the specification. In considering this specification, two questions principally require decision; the first is as to the nature of the diaphragm or tympan referred to; the second is as to the matter of the tension regulator, and what parts necessarily go to make it up as substantially described. It appears that the words tympan or diaphragm ought to receive their ordinary significance, unless there is anything to show to the contrary. The ordinary signification of *diaphragm* I take to be a mere partition or separation—something which, as one witness said, separates something from something else. It is, perhaps, most often applied to a separation existing in that which but for the separation would be a continuous cavity; but it is not in my judgment necessarily confined to that use. A tympanum, or tympan, as the specification uses the word, signifies primarily a thing like a drumhead, in which a substance elastic in itself, but not actually as an elastic substance unless strained, is strained over its circumference and acts in the manner of a drumhead. Now, it will be observed throughout this specification that what Mr. Edison refers to is a diaphragm or tympan. I say that, not forgetting that in some cases he uses the one word and in some cases the other, I think that the quality which he required in his diaphragm is plainly expressed in the specification, namely, that it shall vibrate with the voice. It has been urged upon me that a tympan possesses another quality—that of magnifying the vibrations produced by the voice. It is quite true that a tympan does possess that quality, but it is equally true that a diaphragm by no means necessarily possesses that quality; and it appears to me that using the words interchangeably, and describing the quality that they must possess—that of repeating vibration—it would be wrong to require in everything which is to come within the ambit of this specification a quality not belonging to a diaphragm, and not expressed in the specification as being essential to its operation. He says: "I make use of the vibrations given to a diaphragm or tympan by speaking into a resonant case to produce a rise and fall of electrical tension with such accuracy that the electric pulsations or waves will represent the atmospheric sound waves produced by articulation, and the electro-magnet at the receiving station will respond to the electric waves in such a manner as to reproduce the articulation by acting upon a resonant plate." Hence the diaphragm

or tympan is to be something which will vibrate, and which by its vibrations will give rise to the rise and fall of the electric current. What he aims at is a diaphragm vibrating with the sound waves, nothing more, and by its pressure on the substance below operate on the electric current. Then he says: "The general features thus described pervade my entire invention; but in developing the same many useful and important modifications and variations have been made, which I will proceed to set forth." He proceeds: "The next feature requiring consideration is the character of the diaphragm in the speaking instrument. Many materials have been employed by some, such as metals, horn, vellum, celluloid, ivory, &c., but almost all of these produce a prolonged or secondary vibration from their own resonant character. Hence the articulation is reflective, and the sound vibrations blend. After extensive experiments I find that mica is almost entirely free from any resonant action, and hence it will respond with the greatest accuracy to the sound vibrations, and being of a laminated character can be employed of any desired thickness, and when secured at its edges responds with the greatest accuracy to the sound vibrations, and does not require to be strained. Furthermore, the changes of temperature and atmospheric condition have little or no effect upon the mica diaphagm or tympan." It is plain that the mica structure is not, properly speaking, a tympanum, because it is not strained, and he therefore shows that what he prefers above all others is that which is properly described as a diaphragm, and not a tympan. Of course I do not forget that it has a certain operation as a tympan; but what I mean is that the mica not being strained is not within any conception of a tympanum as usually described. Now we approach his description of a tension regulator. "I have shown several which will be hereafter named; but I find the most delicate to be small bunches, or tufts, or discs of semi-conducting elastic fibre, such as particles of silk, and an intermediate conducting or semi-conducting material. This device I call a tension regulator, and it is, more or less, compressed according to the vibrations of the diaphragm or tympan, and the electric current rises in tension as it is compressed, or lessens as the fibre expands. The fibre is rendered semi-conductive by being rubbed with plumbago, soft metal, or similar material, or by a deposit of metal upon its surface, or by fine particles of conducting or semi-conducting material mixed with it, that conducting power varying with the density of the tuft or branch of fibre." The tension regulator, consisting of the silk with the metallic coating or other substance put over it, is the one which is described in the greatest detail by Edison; but many other forms of tension regulator are described, and those, it appears to me, may be classified in this way:—I find a tension regulator constituted of semi-conductive substance with inherent resiliency, such as the one I have already described; I find others which are to be constituted of a semi-conductive substance of an artificial resiliency that is gained by a spring or other mechanism: I find others in which the operation depends on short circuiting, *i.e.*, diminishing the distance through which the electric current has to travel. These again are of two kinds: one in which the operation is a little complicated, operating by a spring, and another in which the electrodes are inserted in water; lastly there is a very complicated arrrangement with a rheostat, the effect of which I conceive to be that a current which but for the rheostat would have been intermittent is converted into a continuous and undulatory current. The claim made in respect of these regulators is this: "In an instrument for transmitting electric impulses by sound a diaphragm or tympan of mica, substantially as set forth." I have already expressed my opinion that the words diaphragm or tympan must be taken in their natural sense—anything which separates the substance below from the air or the substance above would be a diaphragm; anything which is stretched in the nature of a drumhead would be a tympan—and both these according to that description must be capable of being vibrated by the voice; and if they are that, they are diaphragms or tympans within the meaning of the words of the specification. There remains to consider what is the meaning of the words "tension regulator substantially, as hereinbefore described." It appears to me to be plain that the patentee did not intend to confine them to the particular forms of regulator which have been indicated. The description of the first form is the most minute. I find in that as requisite, first, the quality that with its compression the resistance should be lessened and the current should be increased. This quality is probably present in all cases in which the substance through which the current passes is broken into pieces, where the resistance lessens as the interstices increase, and *vice versâ*. Secondly, I find that the substance must either, from its inherent character or from its composition as a whole, be a semi-conductor: not an absolute non-conductor—for that would spoil the current; not a good conductor, as then the interruption would probably bear so small a proportion to the current as not adequately to influence the stream or create sufficient undulations in the result. The evidence therefore satisfies me that, though theoretically high conductors could be used as tension regulators, and though they had been occasionally used with success, yet practically, and especially with a view to uniformity of result, semi-conductors are best. It is said that this result is due to the fact that in high conductors the point of fusion is low, so that the pieces get fused together; but as it appears that all the high conductors are easily fusible and the semi-conductors are not so, the distinction drawn was sufficient for practical purposes. Thirdly, I find the material must have such a resiliency as will enable it, on the withdrawal of the pressure, to return to its previous condition and thus affect the current which had been increased by the pressure, and be ready again to yield to pressure and again recover its old position. The necessity of such a quality I find expressed not only in the description of the silk as an elastic fibre, and in the various contrivances to produce an artificial resiliency, but in the general description of the nature of the instrument which requires such a recuperative elasticity if it is to act on more than one single occasion. Accordingly I find that in the various forms of tension regulator indicated in the letters-patent this resiliency is acquired in various ways: by the inherent elasticity of the substance, the silk or cork; by the elasticity as in the case where plumbago points are used with springs; and by the pressure of the elastic gases in the interstices of the material, as in the case of the lampblack and coke. I think therefore that the true meaning of the claim which I have just read is the union of a tympan or diaphragm capable of vibrating under the sound waves with an electric tension regulator having the quality which I have just described.

I now approach the question which is very intimately connected with the consideration of the specification—Is Hunnings' transmitter an infringement of Edison's? In Edison's transmitter we find, first, a diaphragm, or tympan, or plate, which receives the sound of the voice; below that there is a cork, not of the same size as the diaphragm, placed in the centre, and of smaller area; below that comes a piece of platina foil, which is the same size as the cork, and corresponds with the size of the cavity in which the tension regulating substance is placed in one of the electrodes in the current; below that comes the lampblack, or other substance which is used as a tension regulator; and below that the bottom of the box, which is itself the electrode, and which is placed across for the purpose of initial regulation. The Hunnings' transmitter is different in this way: that it has no diaphragm or cork, separate from or other than the platinum foil, which receives directly the human voice. They are of the same character in there being a cavity, or cell, in which the metal bottom is one electrode, and the platinum foil at the top the other; but the differences, I believe, to be fairly stated as follows:—First, the materials in the cell are different; coke is used by Hunnings, lampblack preferentially by Edison, and coke is not mentioned. In the next place, the size of the particles is different, those of the lampblack being very much smaller than the particles into which the coke is crushed. Then there is in Edison's the superimposition over the platinum of cork, or disc; and lastly, there is the screw at the bottom, which is applied in the Edison to give initial pressure, and there is a certain amount of difference in their action. In Hunnings', the up and down motion produced by the voice is communicated through the foil to the particles directly. In Edison's the up and down motion of the voice is translated into circular nodal ripples in the disc or tympan; this is retranslated, so to speak, from the centre into an up and down motion, which is communicated to the cork, and which the cork communicates to the foil, and the foil to the air. The result appears to be that the action in the Hunnings' is more accurate, because more direct. In Hunnings' case there is not that magnifying of the operation of the voice that takes place in the presence of the tympan or disc in Edison's. The Hunnings transmitter appears to me therefore to be an improvement on Edison's patent, but it may be none the less an infringement of it, and I have come to the conclusion that, like Edison's, it is the combination of a diaphragm vibrating with the voice with a tension regulator consisting of a semi-conductive resilient and compressible substance, and it is therefore within the scope of Edison's specification.

It has been argued that Hunnings' transmitter acts on a different principle to Edison's—that the one demands compression and the other freedom of motion, that in the one the presence of a diaphragm is essential and that in the other it is not; but the evidence—amongst others of Professor Dolbear—shows that the presence of the foil is essential or useful in both cases. In both it acts as an electrode, in both it requires extension in order that an electric current may pass through all parts of the substance which constitutes the regulator; in both it keeps the inclosed substance in its place. I think it not immaterial to observe that Mr. Hunnings, acting with the assistance of the patent agent in describing his own invention, described the top of the platinum foil as a vibrating diaphragm. That is exactly the conclusion I have drawn, and I have concluded that Edison described by the essential requisite of his invention the combination of a vibrating diaphragm and a tension regulator. Professor Hughes' discovery of 1878, that the vibrations produced by the voice might operate on a heap of particles directly, and without the intervention of any diaphragm or tympan, has, in my opinion, suggested the argument that Hunnings' and Edison's transmitters operate on different principles; but not only is it the fact that the Hunnings' transmitter is not used without the platinum foil, but it has not been shown that it can be so used with success; and, according to the evidence of Professor Thompson, the same physical principle, namely, that of diminishing the resistance and increasing the current by the increase of contact from pressure, underlies alike the tension regulator of Edison and the microphone of Hughes. I now come to consider the two objections which have been made to the validity of Edison's patent on the ground of the nature of the claims. The first of those is based upon the first claim, which is in these words: "In an instrument for transmitting electric impulses by sound, a diaphragm or tympan of mica substantively as set forth." Does that mean that he claims the mica diaphragm or tympan in all instruments for transmitting electric impulses by sound? If it did, it appears to me that the claim would be bad, because I think it is really the claim of the application of an old substance to a particular purpose without the use of any ingenuity in the application; but if it means that the mica diaphragm is claimed in an instrument for transmitting electric impulses by sound, which is described in the specification, then I think that it is not in any way bad, and, upon the whole, I have come to the conclusion that it may be read as relating only to the mica diaphragm in combination with the rest of the instrument. It is to be borne in mind that in construing claims one must construe them not as enlarging the operation of the description, but rather as disclaiming everything which is not claimed. They are inserted for the purpose of drawing the line between what the patentee knows to be old and what he desires to claim as new in the invention he has described. I now come, however, to the last and very serious objection to the validity of the patent. It is this: Mr. Edison discovered an instrument of the highest ingenuity, which is commonly called a phonograph. The instrument is a purely mechanical one: it has nothing whatever to do with electrical or magnetic science: it has nothing necessarily to do with the transmission of sound to a distance:

it is in substance a diaphragm actuated by the voice, which operates upon a style which impresses itself in an impressible plate. The impression which is made on the plate again actuates a style, which again actuates a diaphragm, which again actuates the air. That which is operating the one diaphragm in the form of the human voice is reproduced on the other diaphragm in the condition of audible sounds. Mr. Edison points out in his specification that the voice can thus be produced by the second diaphragm. He also points out that the instrument may be used in another mode, namely, by connecting the second diaphragm with the transmitter, and using that diaphragm as the diaphragm of the transmitting instrument, in which case the second diaphragm produces the audible sound—not immediately, but produces the undulation of the electric current, while at the end of the current the receiver reproduces the audible sound. It appears to me to be plain that Mr. Edison has described a substantive discovery of the very highest interest and ingenuity, by which at one point this instrument receives and reproduces the human voice. What is the claim of Mr. Edison in respect of that apparatus? It is this: "The method herein specified of recording the undulation of a diaphragm of yielding material and the reproduction of sounds by such material acting upon the diaphragm, to communicate to the same vibrations similar to the original one substantially as set forth." It is impossible for me to read that claim and not believe it to be a claim to an instrument, whether used in combination with the electric current or not. Its capacity to produce sound without any relation to the electric current has been pointed out and dwelt upon. The mode of intending was a novelty; the mode of reproducing that sound was a novelty; and the claim appears to me to cover the phonograph in both its applications—its application to produce human sound directly or immediately where the voice had been spoken to it, and its application also as a transmitter of the same voice at a distance. Has the remarkable discovery so made by Edison been in any manner described in the provisional specification? The statute, as we all know, requires that the provisional specification shall describe the nature of the invention; and before I proceed to refer to consider the provisional specification in this case I think it desirable to refer to some authorities which explain the principle upon which I ought to proceed in considering it. In the case of Bailey *v.* Robertson, Lord Blackburn very clearly explains the function of the provisional specification. He says, "The patent law dates from the time of James, and gave a monopoly to the invention of the first inventor; it therefore gave a monopoly solely to the invention which was his invention. He could not claim an invention greater than the title of the patent. But titles were of extreme generality. It is in this particular instance for a means of preserving animal substances. Almost any kind of thing could come under that description. The same title gave very little instruction. Then in the time of Queen Anne, the Attorney-General of that day invented what was obviously a very great improvement. He made it a condition that the patentee should within six months particularly describe and ascertain the invention and the manner in which it was to be performed; if not it should be void. During the six months it would have been a question of evidence on what was the invention for which he went to the Crown and for which the Crown granted a monopoly. Then came the statute of 1852, which introduces further amendment It enacted that when persons went to apply for letters patent they should deposit a provisional specification. That provisional specification describes the invention in terms very different indeed from those in which the final specification described it. Instead of saying it shall particularly describe and ascertain the nature of the invention, and in what manner the same shall be performed, all that the statute says is that in the provisional specification which the applicant leaves with the law officer of the Crown when he applies for a patent he shall state the nature of the invention; no more than that. And then when the law officer of the Crown has looked at it and finds it does state the nature of the invention, but thinks it, as stated, too large or too vague, he may require him to amend it. But if not, then he grants a certificate to use the patent, to use the patent publicly, without at all thereby making a present of the discovery to the public. And when it came to be a question whether or no what he was doing during the six months did void the patent, I take it the process must have been to say: 'Look at the nature of the invention described in the provisional specification and see whether this which you have been doing is fairly within the nature of the invention you have described. If it is you are protected; but if it is a new and separate invention, then you are not protected.' If something were found out during the six months to make the invention work better in which the operation may be performed, the thing which is very likely to happen when, in carrying out his invention, the inventor finds that some particular bit will not work so smoothly as he expected, and it is necessary to add a little supplement to it, while the nature of his invention remains the same—and it is no objection that in the complete specification which comes afterwards the invention is described more particularly and in more detail—if nothing more is done than that, I think it is good; but as soon as it comes to be more than that, and the patentee says in the provisional specification: 'I describe my invention as A.,' and in the complete specification he says: 'I hereby describe A and also B'; then as far as regards B it is void, because the letters-patent were granted for the invention that was described in the provisional specification, and do not cover the invention that was described in the other.'" Again, in the case of Newall *v.* Elliot, the Court of Common Pleas made observations of a similar kind: "The office of the provisional specification is only to describe generally and fairly the nature of the invention, and not to enter into all the minute details as to the manner in which the invention is to be carried out." Similar language is used by the Master of the Rolls in one of the cases which had been referred to, where he says: "It might be roughly, but it must be fairly done." Now I turn to the light thrown by those cases as to the proper mode of construction, to the provisional specification in this case, and find that the title, which is to be read as part of the provisional specification, is, "Controlling by sound the transmission of electric currents, and the reproduction of corresponding sounds at a distance," and the inventor proceeds to say: "The vibrations of the atmosphere which result from the human voice, or from any musical instrument, or otherwise, are made to act in increasing or lessening the electric force upon a line by opening or closing the circuit, or increasing or lessening the intimacy of contact between conducting surfaces placed in the circuit at the receiving station. The electric action in one or more electro-magnets causes a vibration in a tympan or other instrument similar to a drum, and produces a sound, but this sound is greatly augmented by mechanical action. I have discovered that the friction of a point or surface, that is in contact with a properly prepared or slowly moving surface, is very much increased or lessened by the strength of the electric wave passing at such point of contact, and from this variation in the friction a greater or less vibration is given to the mechanism, or means that produce or develop the sound at the receiving station, thereby rendering clear and distinct the sound received, that otherwise would be not audible." I pass on to observe that it is plain that that description refers entirely to the transmission of sound or the controlling of sound by means of electric current, or electricity in some form or other, and cannot, in my judgment, be taken to apply to an instrument which is capable of being worked in a very remarkable manner without the application of electricity in any shape or form. Then the inventor proceeds in these words—"To carry out the peculiarities of my invention under the varying conditions of use, I have devised several modifications of the transmitting, receiving, and intensifying devices employed in this sound telegraph," all evidently referring to sound to be transmitted to a distance; "portions of the apparatus are interchangeably available in transmitting or recording." I observe in passing that the evidence goes to show that at that time recording, as used in telegraphy, meant some sort of telegraphic representation of the sound, because no other had been known till this invention was made. "Others are adapted to local use, some are only available in transmitting, and others are only for receiving, and some portions of my improvement can be availed of to make a record of the atmospheric sound waves, or of the electric waves or pulsations corresponding thereto, or resulting therefrom." No doubt some of these words do explain what might be held to refer to an instrument like the phonograph; but when I ask myself whether they describe the nature of the invention, I am bound to say that they do not. These, as I have already observed, are merely methods for carrying out the peculiarities of the invention, which invention, I repeat, is confined to the transmission of sounds by electrical agency to a distance. Supposing an inventor had, during the six months which preceded the complete specification, invented the phonograph, not as applied to the electric telegraph, but operating by itself, can it be said that that invention would have been protected by the description contained in this provisional specification of that instrument? I agree that the provisional specification need not describe the manner in which an invention is to be carried into effect. I agree that it need not describe the nature of the invention otherwise than roughly, but it ought to do so fairly and honestly; and if Mr. Edison was at the time at which these letters-patent were granted in possession of that very remarkable mechanical invention by which speech could be reproduced, not necessarily at a distance, but in the same room as that in which it was uttered, I do not think the provisional specification was an honest statement of the nature of that discovery.

On that ground I come to the conclusion that Mr. Edison's patent cannot be upheld, and I must therefore grant an injunction in respect of the first part, and dismiss the action as regards the second.

Then as to the question of costs, and upon the best consideration which I can give, I think I should act in mercy to the parties if, instead of apportioning the costs, I grant the injunction without the costs, and I do so accordingly. The form of injunction will be the usual one, as at page 352 of Sir Henry Seton's book:—"That the injunction be awarded to restrain the defendant, his agents, tenants, &c., during continuance of the letter patent, or any extension thereof, from manufacturing, or selling, or disposing, or using any instrument of the same construction, or any colourably differing therefrom, or any other instrument constructed according to the plaintiff's patented invention, or any colourably differing therefrom, or being an enlargement of the plaintiff's said patent, and from in any way infringing the plaintiff's said patent."

In answer to Mr. Aston, Mr. Justice Fry said that he could have reference as to damages. Mr. Aston said that by the Patent Law Amendment Act his lordship in directing costs to be paid would have regard to the issues which are raised, and apart from the general costs of the case he would ask his lordship to take into consideration the issues which had been raised in reference to the Edison case. Mr. Justice Fry said he thought that was the strict measure of right. He must therefore dismiss the action and costs as regards the second patent, and grant an injunction of costs as regards the first.

Mr. Aston asked that the plaintiff's costs incurred in meeting the objections of the defendant in regard to the invalidity of the Edison patent in regard to the infringement of Edison's patent be the plaintiff's costs, notwithstanding that he had failed in his law point.

Mr. Justice Fry said that in a general way the man who failed got no costs, though he might have succeeded on some points.

Mr. Aston thought this might meet the case: no costs to either side as to the Edison, costs of plaintiff as to Bell.

Mr. Justice Fry would refuse that: he would only grant the injunction in this form—from manufacturing, or selling, or disposing of, or using any instrument of the same description as the Cox-Walker and Hickley exhibits, or only colourably differing therefrom, or any instrument constructed according to the particular letters-patent, or only colourably differing therefrom, or being an infringement of the plaintiff's said patent, and from in any way infringing the said patent.

IN THE SUPREME COURT OF JUDICATURE.
COURT OF APPEAL.

MR. COZEN HARDY on the 22nd inst. made application in the above matter, on behalf of the United Telephone Company and Harrison, Cox-Walker and Co., that the case should be set down as an appeal, notwithstanding the order has not been drawn up. After some discussion the Master of the Rolls said: "It would not be regular to set it down before the order is drawn up; and really, as I have said before, there is no possible chance of it being taken this side of the long vacation."

Application refused accordingly.

It may not be within the knowledge of everyone that the suit which we have just alluded to was contested by Mr. H. Eldred, of the London Globe Telephone Company, the real proprietor of the Hunnings transmitter. This gentleman will, we have no doubt, within a few days, give notice of appeal against the injunction to restrain the defendants from using the Hickley and Cox-Walker receivers. There will therefore be cross-appeals. These cannot come on until near the close of this year.

We desire in this place to record our indebtedness to Messrs. Davidson and Morriss, the talented and energetic solicitors for the defence. Through the invariable courtesy which we have met with from these gentlemen, the efforts of our own special reporter have been greatly aided, and we have much pleasure in rendering them our hearty acknowledgments.

ANOTHER TELEPHONE LAWSUIT.—It may be remembered by some of our readers that the Bell Telephone Company commenced an action against Messrs. Jackson and Co. (J. Orme and Co.) for alleged infringement (by the sale of the Hickley telephone) of the Bell patent, owned now by the United Company. This action has been slumbering for about two years, and is now, we believe, abandoned. On Thursday last the United Company applied for an injunction against Messrs. Orme and Co., to restrain them from selling the Hickley telephone. As the defendants did not put in an appearance the injunction was granted.

NOTES.

ELECTRIC LAMP PATENTS.—We are informed upon good authority that the two patents of Kennedy, No. 5,524 of 1881 and No. 1,199 of 1882, were opposed at the "notice to proceed" stage, and that the opposition is still pending. We mention this fact as the Railway and Electric Appliances Company, now advertising their shares for subscription, are, it is said, the proprietors of these Kennedy patents, but the prospectus of the company does not intimate that there are any legal complications attached to the inventions. Is it possible that there are two Kennedys with electric lamp patents, or are we to infer that the above company is endeavouring to float a property respecting which litigation is pending?

THE TELEPHONE.—In the House of Commons, on the 19th inst., Mr. R. Martin asked the Postmaster-General when he would be able to state the conclusion at which he might have arrived as to granting a licence to the London and Globe Telephone Company, authorising them to work in London and its suburban districts; and whether he had any intention of purchasing the business of one particular company at a large price, and thereby creating a monopoly of telephone service, by which the public would be deprived of the benefit of a helping competition in the development of a scientific invention, which might still be considered to be in its infancy. Mr. Fawcett: I have received applications, not only from the London and Globe Telephone Company, but from other telephone companies for licences to carry on business in various towns, where a telephone exchange is already established, either by a private company or by the Post Office. The important questions involved in these applications have for some time engaged my attention. I am not yet in a position to announce my decision, but I can assure my hon. friend that there shall be no unnecessary delay in arriving at a conclusion, and in making it known. With regard to the latter part of his question I may state that the Government have no intention of purchasing the business of any telephone company. (Hear, hear.)

THE TELEPHONE DECISION.—The following letter was addressed to the Editor of the *Times*, by Professor Sylvanus Thompson, on the 19th inst.:—

Sir,—As scientific adviser to the gentlemen who own the instrument known as the Hunnings transmitter, which has been the subject of the litigation in which Mr. Justice Fry's decision was rendered to-day, I desire to remark that although by to-day's decision Edison's patent, which the plaintiffs claimed to cover Hunnings' invention, has been pronounced void, yet there are, independently of the general voidance of Edison's patent, grounds for holding that Hunnings' invention is absolutely distinct from Edison's. Edison claimed as his telephonic transmitter a combination of a tympan or diaphragm with a tension-regulator, naming as materials for the latter lampblack, plumbago, platinum, &c. He does not claim the use of these materials apart from a tympan or diaphragm. In Hunnings' transmitter coke is used, and the mechanism of Edison's telephone, including the mica diaphragm or tympan, the adjusting springs or screws, and the cork presser wherewith to act upon this material, has been wholly rejected as in Hughes' well-known microphone. The result of this is that the voice is transmitted much more perfectly by Hunnings' transmitter, because the sound waves act directly, instead of acting through the indirect mechanism of the combination which Edison claims. It must be confessed that it is difficult to understand how Mr. Justice Fry can regard Edison's mica disc fixed at its edges as not being a "tympan," when he himself in his judgment says, "I do not forget it has a certain operation as a tympanum."

Again, Mr. Justice Fry has stated that Reiss's telephones of 1863 were found "occasionally and uncertainly to reproduce vocal sounds with musical ones," and he appears to regard the transmission of speech by such instruments as being a mere accident, and not the intention of the inventor. This is at least remarkable when we find in the instructions issued with those early instruments definite directions as to what to do in order to notify the operator by signals when to speak to the transmitting instrument and when to sing to it, which instructions would not have been given unless the instrument had been intended to speak as apart from singing.

Whatever may be the ultimate issue of this decision, the public, at least, will not suffer by the creation of a healthy competition with the existing monopoly; and it is worth while to point out that if Edison's claim to monopolise all the practical carbon transmitters, such as those of Blake, Hunnings, and Crossley, be now at an end, there is also, at least, one other practical telephone receiver besides that of Bell, viz., that of Dolbear, which has lately been introduced into this country, and promises to be even more successful than that of Bell for telephoning over long distances.

THE CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY.—The India-Rubber, Gutta-Percha, and Telegraph Works Company received on the 22nd inst. a telegram from Mr. R. K. Gray, their Engineer-in-Chief, announcing the safe arrival of the ss. *Silvertown* at Santa Elena (Ecuador). All well on board.

Santa Elena is the place from where the *Silvertown* commences her cable-laying operations, towards Salina Cruz, near Tehuantepec, in Mexico. The completion of the Santa Elena-Buenaventura and Buenaventura-Panama sections is daily expected.

The ss. *Dacia* arrived on Monday, the 22nd inst., at Liverpool, on her return from the West Coast of South America.

A CABLE SHIP ADRIFT.—We see from the daily newspapers that the Dutch mail ss. *Amsterdam* passed Dover on the 17th inst., and signalled that the French steam transport *Charente* was adrift in Lat. N. 45, and Long. 7, W., with engines disabled. Since then no further news has been received. It will be remembered that the *Charente* left the river on the 10th inst., with the cable on board which was to be laid between Bone and Bizerte.

THE EDISON ELECTRIC LIGHT IN AMERICA.—Mr. Edison's incandescent electric light has been introduced in the composing and stereotyping rooms of the Philadelphia *Public Ledger*, and used successfully, entirely replacing gas. Seventy-four lamps are used, of 16-candle power each; and the electricity is furnished by one dynamo machine, driven by a special engine. Eight lamps are supplied for each horse-power.

SUBMARINE TELEGRAPHIC ENTERTAINMENT.—On the afternoon of Wednesday next, at St. George's Hall, Regent Street, Mr. F. C. Webb, the well-known electrician, will give what will be found, perhaps, the most novel entertainment ever brought before the public. The first part of the programme is devoted to a *viva voce* explanation of the *modus operandi* of laying submarine telegraph cables, illustrated by large coloured drawings of ships and cable-laying machinery. In the second part Mr. Webb will go through the actual process of testing two sections of cable, and then splicing them together; during which operations he will be assisted by engineers, electricians, cable hands, &c. The entertainment, which commences at 2.30, will be enlivened by the vocal abilities of several well-known artistes, and in the last

scene Mr. Webb will, in his character of "engineer-in-charge," take part in a vocal duet with Madame Thea Sanderini. We trust that the entertaincr will have no fault to find with the "paying out" gear. Tickets may be obtained at the following places:—Mr. Alfred Hays', 4, Royal Exchange Buildings, E.C., and 26, Old Bond Street, W.; Mr. R. J. Mitchell & Son's, 36, Parliament Street, Westminster; Mr. Edwin Harper's, Steele's Terrace, Haverstock Hill; and at St. George's Hall.

WATER POWER AND THE ELECTRIC LIGHT.—It is rumoured that a wealthy company is making arrangements to buy the water power at Harper's Ferry on the Upper Potomac river with a view of lighting Washington City and Baltimore by the electric light.

THE EARLIEST USE OF THE INCANDESCENT ELECTRIC LIGHT.—A correspondent writing to our contemporary *Nature* of the 18th inst. says the following extract from a memoir by Sir William Grove, published more than thirty-six years ago, will be of interest to future historians of the progress of lighting by electricity. The memoir is entitled "On the application of Voltaic Ignition to Lighting Mines," by W. N. Grove, F.R.S., and is published in the *Philosophical Magazine*, May, 1845. It begins by stating that M. de la Rive had proposed the use of the voltaic arc for illuminating mines; it describes the apparatus employed by him, and the difficulties that prevented its practical application, and continues as follows:—

I substituted the voltaic ignition of a platina wire for the disruptive discharge. Any one who has seen the common lecture-table experiment of igniting a platina wire by the voltaic current nearly to the point of fusion, will have no doubt of the brilliancy of the light emitted; although inferior to that of the voltaic arc, yet it is too intense for the naked eye to support, and amply sufficient for the miner to work by. My plan was then to ignite a coil of platinum wire as near to the point of fusion as was practicable, in a closed vessel of atmospheric air, or other gas, and the following was one of the apparatus which I used for this purpose, and by the light of which I have experimented and read for hours:—A coil of platinum wire is attached to two copper wires, the lower parts of which, or those most distant from the platinum, are well varnished; these are fixed erect in a glass of distilled water, and another cylindrical glass closed at the upper end is inverted over them, so that its open mouth rests on the bottom of the former glass; the projecting ends of the copper wires are connected with a voltaic battery (two or three pairs of the nitric acid combination), and the ignited wire now gives a steady light, which continues without any alteration or inconvenience as long as the battery continues constant, the length of time being of course dependent upon the quantity of the electrolyte in the battery cells. Instead of making the wires pass through water, they may be fixed to metallic cups well-luted to the necks of a glass globe.

The spirals of the helix should be as nearly approximated as possible, as each aids by its heat that of its neighbour, or rather diminishes the cooling effect of the gaseous atmosphere; the wire should not be too fine, as it would not then become fully ignited; nor too large, as it would not offer sufficient resistance, and would consume too rapidly the battery constituents; for the same reason, *i.e.*, increased resistance, it should be as long as the battery is capable of igniting to a full incandescence.

The memoir concludes with the description of experiments on the illumination power of this contrivance under different conditions.

THE EDISON SYSTEM OF ELECTRIC LIGHTING IN NEW YORK.—The following account of Edison's progress in New York, which we extract from the *Review of the Telegraph and Telephone*, will interest our readers who are already familiar with what has been done with this system in London. We should welcome such an undertaking here, and we feel sure that it would receive the warmest support in every way.

The work of running the wires for the Edison lamps in the down-town district, bounded by Spruce Street, Wall Street, Nassau Street, and the East River, is rapidly approaching completion, and the fitting up of the central station at No. 257, Pearl Street, goes on at the same time with the laying of the street mains. The whole work of preparation may be divided into four branches: (1) the fitting up of the station for the plant; (2) the manufacture and installation of engines, dynamos, and other necessary apparatus; (3) the manufacture and laying of the street mains; and (4) the wiring of the houses. The work on the station, including a masonry foundation and a two-storey iron framework for the machinery, and four boilers with a capacity for 1,000-horse-power, is sufficiently advanced for the building to be ready for the six engines, six dynamos, and other apparatus. The engines were built by the Southwark Machinery Company, Philadelphia, and are now in the hands of the Edison Machine Company; they have a total maximum capacity of 1,200-horse-power. The six dynamos are nearly finished at the Edison machine shops in Goerck Street. The weight of each dynamo is thirty tons. The boilers, when worked to their full capacity, will burn five tons of coal a day, and consume 11,500 gallons of water.

Up to the 1st of April, 55,300 feet of street mains had been laid of the 75,000 feet of main which will be required in all. The wiring of the houses was finished in February. In Beekman Street 107 houses have been wired; in Fulton Street, 166; in John Street, 75; in Maiden Lane, 78; in William Street, 97; in Front Street, 46; in Nassau Street, 68; in Pearl Street, 43; in Cedar Street, 36; in Pine Street, 28; in South Street, 24; in Ann Street, 31; in Spruce Street, 12; and enough in other streets to make 946 houses or business places wired ready for the lamps. The number of lamps to be put in is 14,311, of which 7,916 are of 16 candle-power, the remainder of 8 candle-power. The lamps were made months ago and can be put in at a day's notice. The central station will supply electric current not only for the lamps but also to run motors for elevators, and machinery of all kinds.

ELECTRIC LIGHTING.—Mr. W. H. Preece, in a letter to the *Times* of the 24th inst., says:—

"There is great confusion between the problem of the subdivision of the electric 'light' and that of the distribution of the electric 'current.' They are two totally different questions, which are generally mistaken for each other. If a given current, say, that equivalent to one horse-power, will give a light, say, of 2,000 candles, you cannot by any known means divide that light into 20 lamps of 100 candle-power each. The best that has hitherto been done from one horse-power is to obtain eight lamps of 16 candle-power each. You can, however, distribute the current in any way you please. If one horse-power will give you one lamp of 2,000 candle-power, or eight lamps of 16 candle-power, it is evident that two horse-power will give you two lamps of 2,000 candle-power or 16 small lamps; three horse-power, three lamps of 2,000 candle-power or 24 small ones, and so on, directly by multiplication and distribution. Mr. Brush has shown how to multiply his lamps, and Mr. Edison has shown how to distribute his currents and multiply his lights; but no one has as yet attempted to solve the question of the subdivision of the electric light. The largest machine yet made, that of Edison, will maintain 1,200 incandescent lamps giving 16 candle-power each, or a total light of 192,000 candles, with an expenditure of 150 horse-power. Such a power applied directly to the production of light ought to give a light of many million candles.

"Although I still maintain that the useful subdivision of the electric light is not to be hoped for, it is not to be assumed that I or any one else opposes the distribution of the electric current and the multiplication of electric lamps."

THE SWAN ELECTRIC LIGHT.—In the "Money Market" article of the *Times* of the 24th inst., there appeared the following letter:—

"1, New Court, Carey Street, W.C., May 23.

"Sir,—The attention of the directors of the Edison Electric Light Company has been called to the prospectus of the Swan United Electric Light Company (Limited), which has appeared this morning. As the solicitors of the Edison Company we are instructed to state that the Board of that company are advised that the lamp known as the Swan incandescent lamp, which the new company proposes to manufacture and supply, is an infringement of the Edison Patents.

"We are, Sir, your obedient servants,

"WATERHOUSE AND WINTERBOTHAM."

Subjoined is a reply to this letter:—

"6, Old Jewry, London, E.C., May 24.

"Sir,—With reference to the letter of Messrs. Waterhouse and Winterbotham in the *Times* of this morning, we are instructed by the directors of the Swan United Electric Light Company (Limited) to say that they are advised that the Swan incandescent lamp is not an infringement of the Edison or any other patent.

"The Swan lamp has been before the public unchallenged for a considerable time, 1,200 of the lamps having been nightly in use for several months past at the Savoy Theatre alone.

"Yours obediently,

"ASHURST, MORRIS, CRISP, AND Co., Solicitors to the Swan United Electric Light Company (Limited)."

Is this the beginning of a sham battle preparatory to a combination of the two companies?

THE JABLOCHKOFF LIGHT.—The contract for illuminating the Avenue de l'Opéra with the Jablochkoff candles has been renewed by the Municipality of Paris for three years. Power has been granted, in connection with this new contract, to introduce the light into the houses in the district.

ELECTRICAL FINANCING.—An ably-written but exceedingly severe article on this subject appeared in *Truth* of the 18th inst., dealing very much with the Sellon-Volckmar accumulators. By the following letter, which has been forwarded to us, it will be seen what are the replies which Mr. Sellon makes to the charges brought forward by the writer of the article in question:—

THE SELLON-VOLCKMAR ACCUMULATORS.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Certain statements have lately appeared relating to the above-named accumulators or storage batteries, the patents of which belong to the "Electrical Power Storage Company." With regard to these statements, it is scarcely necessary to give any explanation to those who know me, but as many who may be nevertheless in-

terested in the subject do not, I shall feel greatly obliged if you will publish the following particulars:—

Having for long given attention to secondary batteries, and having succeeded in obtaining results which I considered of great value, I took out in England in *September* last, certain patents, supplemented later by others; these patents would at the same time have been applied for throughout the world, but for the necessity of awaiting the completion of my final specifications.

Toward the end of *December*, Mr. Volckmar, whose name I then heard for the first time, was introduced to me as possessing a secondary battery of much merit, which upon examination proved to be in essential points the same as my invention. The patents had been taken out by him in October in many Continental countries, as also in England, and thus the position was that, although later than myself in his application for England, the Colonies, and America, he had anticipated me for the Continent generally. An arrangement was therefore made for the amalgamation of our respective interests.

At this juncture a patent was published, taken out by Mr. Swan, of Newcastle, in May, 1881, covering a portion of my first specification, and, to prevent any possible difficulties arising in the future, I purchased his rights for a considerable sum, and thus the combination of these patents was completed.

I need not here detail the features of the Sellon-Volckmar accumulator, further than to say that, in the judgment of some of the best scientific authorities of Europe, it is an absolutely new and very valuable form of secondary battery, and in no way an infringement upon the Faure, which I assert it greatly exceeds in power and durability.

It was the intention of Mr. Volckmar and myself to deal personally with our patents, but a few intimate friends, who knew of the results obtained, expressed the wish to join with us in their development and a small private company was formed, *the internal arrangements of which are no concern of the public, any more than those of a private firm*, inasmuch as no member of the public was ever asked to subscribe, or did subscribe, one single farthing.

The terms which were arranged for the cession of the patents to the Electrical Power Storage Company only concern those (all of high position and thorough business qualities) who approved of and entered into them.

The exact facts are, however, that *the cash paid covered only the expenditure already incurred*, the whole benefits of which were transferred to the company; and that we, the owners of the patents, who had the full right to ask what terms we thought fit, made our whole interest and profit in the business dependent upon its success, and that for a total amount of fully paid-up shares which might, with the probable extension of capital, yield us each a proportion of the profits equal only to three-sixteenths, we ceded our patents *for the whole world*.

With regard to not guaranteeing the validity of the patents, no counsel of standing ever allows his clients to "guarantee" their patents, however sure they may be of their validity, and the usual clause, which I have always accepted myself in *purchasing* patents, was inserted in regular course. The case was however altered when applications were made for concessions or purchase of patent rights, *after an attack, which we cordially invited*, had been threatened by the Faure Company, and it was determined to protect any subscribers to subsidiary companies against the contingency of an adverse issue by guaranteeing the return of all moneys received.

The Electric Carbon Company of Scotland has nothing to do with the "Electrical Power Storage Company." Until I saw the prospectus in the newspapers, I did not even know of its formation.

With reference to Mr. Volckmar, whom I have found to be a gentleman of honour and integrity, the matter has come before the law courts, Mr. Volckmar having immediately, upon the publication of the libel, commenced an action; and any discussion thereupon at present would be out of place.

May 20th, 1882. JOHN S. SELLON.

NEW COMPANIES REGISTERED.

ELECTRIC LIGHT AND POWER SHARE TRUST, LIMITED.—Capital £1,000,000 in £2 shares. Objects: To purchase and hold stock, shares, debentures, and other securities of companies formed for the use and development of electricity. Signatories (with one share each): J. Bewster, 6, Corinne Road, N.; J. F. Freegard, Walthamstow; Francis Perry, 23, Mincing Lane; W. W. Bird, Fulham; J. C. Harvey, Anerley; W. H. Robinson, 15, Lilford Road, Brixton; C. F. Ince, 1, Church Court, Old Jewry. Directing qualification, shares or stock to the nominal value of £500; remuneration, £1,500 per annum, and £50 additional for each £100,000 of issued capital beyond the first £250,000. The first three signatories are to nominate the first directors. Mr. Perry is appointed managing director for five years at a salary of £750 per annum, and a further £100 for each one per cent. dividend beyond 6 per cent. on the paid-up capital. Registered 17th inst. by Lumley and Lumley, 15, Old Jewry Chambers.

IBERIAN ELECTRIC COMPANY, LIMITED.—Capital £10,000 in £10 shares. Office: 20, Bucklersbury. Objects: To purchase the letters-patent of Messrs. Brush and Lane-Fox for Spain, Portugal, and their Colonies. Signatories (with one share each): R. S. Ward, 24, Grafton Street, Mile End; H. Leaver, 133, Gray's Inn Road; J. E. Costello, 20, Bucklersbury; A. J. Davis, 19 and 21, Queen Victoria Street; T. Jervis, 28, King Street, E.C.; Luke Bishop, 99, Cannon Street, E.C.; William Best, 14, St. Mark's Crescent, N.W. Registered 17th inst. by Walter Webb and Co., 23, Queen Victoria Street.

ANGLO-PACIFIC ELECTRIC LIGHT, TELEPHONE, AND POWER COMPANY, LIMITED.—Capital £300,000 in £5 shares. Objects: To acquire the shares and property of La Conpania Chilena de Telefonos de Edison, and to carry on the business of telegraph, telephone, and of electric light and power companies. Signatories (with one share each): C. F. Willard, 14, Earl's Court Gardens; E. D. Lane, 42, Hullington Street, Clapham; C. M. Turner, 15, Clifton Road, Brockley; G. Brickley, 12, Winthorpe Road, Putney; A. Spencer, 54, Arundel Square, Barnsbury; J. S. Leeds, 21, Salisbury Street, Strand; W. L. Goodfellow, Hampstead. Directing qualification, 50 shares; remuneration, £1,500 per annum, and 20 per cent. of balance of net profits after payment of 10 per cent. dividend. The first directors are: Stewart Pixley, R. Ewing, W. C. Harvey, H. B. B. Kennett, and J. G. Sandeman. Registered 17th inst. by Davidson and Morriss, 40 and 42, Queen Victoria Street.

PHŒNIX ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £250,000 in £1 shares. Objects: To manufacture and supply generators, accumulators, lamps, and electric apparatus and fittings generally. Signatories (with one share each): F. Gane, 51, St. John's Road, N.; F. C. Boyle, East Ham; Hy. Harris, 14, Devonshire Square, E.C.; W. B. Kew, 25, Graham Road, Dalston; J. Ferguson, 99, St. Paul's Road, Highbury; G. R. Statham, 98, Bishopsgate Street; T. J. Warner, 8, Great Winchester Street Buildings. Directors' remuneration, £400 per annum to the chairman and £300 for each ordinary director. Registered 17th inst. by C. Doubble, 14, Serjeants' Inn, Fleet Street.

SCANDINAVIAN ELECTRIC COMPANY, LIMITED.—Capital £10,000 in £10 shares. Office, 20, Bucklersbury. Objects: To purchase the letters-patent of Messrs. Brush and Lane-Fox for Sweden, Denmark, Norway and their Colonies. Signatories (with one share each): T. D. Whitehead, 8, Mount Terrace, Hercules Buildings, Surrey; A. Mason, 16, Bernard Street, Russell Square; J. Kelly, 46, West Wing, Rochester Buildings, Victoria Street; R. Gordon, New Malden, Surrey; H. J. Bass, 13, Henrietta Street, Covent Garden; J. A. Eaton, C.E., 2, Priory Villas, Starch Green; R. Coffee, 13, Balfour Road, Highbury New Park. Registered 17th inst. by Walter Webb and Co.

ELECTRIC WORKS COMPANY, LIMITED.—Capital £50,000 in £1 shares. Objects: To manufacture and supply electric machines and apparatus, including engines for supplying locomotive or other power. Signatories (with one share each): W. J. Hurst, 6, Clifton Square, Peckham; W. R. Parker, 11, Glengall Road, S.E.; Hy. Moulding, 2, Maltby Street, Bermondsey; Wm. Jackson, 134, Falmouth Road, S.E.; J. Williams, 13, Bermondsey Square; J. Smith, Bruce Grove, Tottenham; A. E. Honeybourne, 131, Drummond Street. Registered 17th inst. by T. E. Briggs, 8, Finch Lane.

BIRMINGHAM AND WARWICKSHIRE BRUSH ELECTRIC LIGHT AND POWER CO., LIMITED.—Capital £100,000 in £2 shares. Objects: To purchase a concession from the Hammond Electric Light and Power Company, Limited, for the use of the Brush system in Birmingham and Warwickshire. Signatories (with 50 shares each): Sir W. Smith, Bart., Westbourne Terrace; F. Putwee, 148, Fenchurch Street; D. Evans, 24, Watling Street; J. M. Felton, 6, Well Street; R. G. Molyneux, 2, Lyall Street, S.W.; T. J. Hitchmis, 16, Rood Lane; A. Hodson, 35, Belsize Road. Directing qualification, 50 ordinary shares, re-remuneration, £1,000 per annum and one-tenth of divisible profits over 10 per cent. Registered 17th inst. by Ingledew and Ince, S. Benet Chambers, Fenchurch Street.

STAFFORDSHIRE AND WORCESTERSHIRE ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £200,000 in £2 shares. Office, 23, St. Swithin's Lane. Objects: To adopt an unfiled agreement of 17th between Clement Gibbs and U. R. Macey. Signatories (with five shares each): E. L. W. Chave, Upper Richmond Road, Putney; F. G. Pawler, 2, Moorgate Street Buildings; C. Gibbs, 49, Belsize Square; S. Brenell, 105, Highbury New Park; W. Theobold, F.C.A., 2, Ashley Road, Hornsey Rise; T. H. T. Rogers, 14, Queen Victoria Street; *F. G. Dart, 16, Philpot Lane. J. Spencer Balfour, M.P., E. G. Clarke, and F. C. Perry, J.P., are members of the first board. Remuneration, £1,000 per annum and one-tenth of all profits above the first 10 per cent. Registered 17th inst. by Rogers and Chave, 14, Queen Victoria Street.

DUPLEX ELECTRIC LIGHT, POWER, AND STORAGE COMPANY, LIMITED.—Capital £100,000 in £1 shares. Objects: To acquire the letters-patent for the United Kingdom of the "Duplex" system of electric lighting. Signatories (who with one exception subscribe for one share each): *W. G. F. Hunt, 8, Duke Street, St. James's; J. F. Kelley, 35, Ganden Road, Clapham; W. B. Thornhill, 19A, Clifford Street, Bond Street; R. F. Bellis, 8, Graham Terrace, Walham Green; *E. B. Illidge, 4, Queen Victoria Street; J. O. Byrne, 2, Highfield Villas, Brixton; J. Mallard, 19, Perham Road, Brixton (five shares). Directing qualification 100 shares. C. Drake, C. W. White, and Dr. F. G. Lilley are members of the first board. Remuneration £100 per annum to each director. Registered 18th inst. by S. Boome, 7, Conderton Road, Camberwell.

JABLOCHKOFF ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £300,000 in £5 shares. Objects: To carry on the usual business of an electric light company, and for that purpose to carry out an agreement of 16th inst. between the London Contract Company and Thomas Smith. Signatories (with one share each): J. A. Barrett, Nutcroft Road, Peckham; Wm. Baker, St. Clement's House, E.C.; Wm. Tolhurst, 42, Finchley Road, Camberwell; R. Hodson, 108, Marylebone Road; W. D. Elleston, Leighton Buzzard; H. W. Freeman, 7, Phillimore Terrace; T. P. Lee, 6, Gloucester Crescent, N. W. Directing qualification, 25 shares; remuneration, chairman £400 and each director £250 per annum. Registered 18th inst. by Brandon and Co., 15, Essex Street.

YORKSHIRE BRUSH ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £300,000 in £2 shares. Objects: To purchase for £37,500 cash and £37,500 in fully paid shares, the right to use the Brush system in Yorkshire. Signatories (with one share each): F. W. Ince, St. Benets Chambers; T. W. Catherwood, 81, Victoria Park Road; W. R. Jackson, 12, Albion Terrace, Highbury; C. H. Vanderpump, 77, Isledon Road, N.; F. B. Lilley, 45, Alexandra

Park Road; G. Crowley, 3, North Street, Westminster. Directing qualification, 25 shares. Registered 18th inst. by Ingledew and Ince, St. Benets Chambers, Fenchurch Street.

ANGLO-SPANISH (BRUSH) ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £500,000 in £5 shares. Objects: To carry out an agreement of 18th inst. with the Iberian Electric Company, Limited, and Arthur Davis. Signatories (with one share each): Francis Tisser, 32, Cambridge Gardens; C. Wapshawe, Selhurst Road, South Norwood; E. Eleinger, C.E., 6, Queen Victoria Street; J. Kincaid, C.E., 11, Great George Street; A. J. Davis, 19 and 21, Queen Victoria Street; G. S. Fleet, Gurney Lodge, Stratford; J. E. Costello, 20, Bucklersbury. Directing qualification, £250 (nominal) in shares or stock; remuneration, £1,500 per annum. Registered 18th inst. by Walter Webb & Co., 23, Queen Victoria Street.

BRITISH INSULITE COMPANY, LIMITED.—Capital £250,000, divided into 24,900 A shares of £10 each, and 1,000 B shares of £1 each. Objects: To purchase from the Insulite Company, Limited, two letters-patent relating to improvements in electric insulation. Signatories: M. M. Moore, 83, Lombard Street, 350 shares; *G. K. Rickards, Oxford, 100 shares; E. Easton, C.E., 7, Delahay Street, 200 shares; *J. Dummett, C.E., 54, Porchester Terrace, 250 shares; F. Sanders, 11, Delahay Street, 25 shares; J. W. Robinson, 3, Dr. Johnson's Buildings, Temple, 25 shares; A. White, 76, Coleman Street, 50 shares. Directors' qualification, 100 A shares or £1,000 A stock; remuneration, £400 per annum to the chairman, and £100 per annum to each other director. A further annual sum of £100, multiplied by the number of directors, will be divided amongst the directors. Mr. Latimer Clark is appointed a director. Registered 19th inst. by Waterhouse & Co., Lincoln's Inn.

SWAN UNITED ELECTRIC LIGHT COMPANY, LIMITED. — Capital £1,000,000 in £5 shares. Objects: To carry into effect several agreements relating to the Swan system of electric lighting. Signatories (with 100 shares each): Charles Morrison, 53, Coleman Street; W. C. Quilter, 14, King's Arms Yard; H. H. Dobree, 6, Tokenhouse Yard; E. W. Batt, 20, Great Winchester Street; Elton Mias, 20, Great Winchester Street; C. Waring, 10 Victoria Chambers, Westminster; C. Cox, 14, King's Arms Yard. Directing qualification 200 shares; remuneration, £2,000 per annum. Registered 19th inst. by Ashurst, Morris, Crisp and Co., 6, Old Jewry.

TELEPHONE AND ELECTRIC LIGHT AGENCY, LIMITED. — Capital £10,000, in £1 shares. Objects: To carry on business as manufacturers of telegraphic, telephonic, and electric apparatus generally. Signatories: *G. Ager, LL.D., 50, Wellington Road, Stoke Newington, 100 shares; *J. F. Hincks, 45, Finsbury Pavement, 10 shares; J. Green, 125, The Grove, Hammersmith, 10 shares; C. A. Tackley, 398, Liverpool Road, 1 share; J. Winckworth, 10, Coleman Street, 10 shares; C. Clements, 10a, Warwick Street, Regent Street, 1 share; A. Busby, 11, Eton Street, N.W., 1 share. Directing qualification, £10 in shares or stock. Mr. R. C. Cutting, of Wardrobe Chambers, Queen Victoria Street, is a director. Registered 19th inst. by Winckworth, 10, Coleman Street.

STUART ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—Capital £600,000 in £2 shares. Objects: To acquire and work the inventions of John Medley Stuart relating to improvements in electric lighting. The consideration is 299,993 fully paid shares. Signatories (with one share each): P. London, 19, Sidney Square, E.; E. U. George, 3, Norcott Road, N.E.; R. Nettleton, 11, Queen Victoria Street; T. Holinski, 11, Queen Victoria Street; J. Jackson, 280, Commercial Road; T. Towey, 39, Abingdon Villas, S.W.; S. W. Willard, 14, Earl's Court Gardens. Registered 22nd inst. by Wright and Co., 11, Queen Victoria Street.

* Signatories whose names are preceded by an asterisk are also directors.

CITY NOTES.

OLD BROAD STREET.

THE LONDON PLATINO-BRAZILIAN TELEGRAPH COMPANY, LIMITED.

ON Friday the 19th inst. Mr. John Pender, M.P., presided at the fourth ordinary general meeting of the shareholders of the above company, held at the offices of the company, 66, Old Broad Street.

The notice convening the meeting and the minutes of the previous general meeting were read by the secretary, Mr. William Payton, and approved.

The Chairman then said: Gentlemen, you have had the report in your hands some days, will you take it as read? Before asking you to approve of the report it is usual to say a few words as to the progress of the company since I last had the pleasure of addressing you. The revenue for the last year amounted to £18,307 against £21,107 for the previous year, being a decrease of £2,800. This falling off is attributable to the causes mentioned in the report—undue competition of the Brazilian Government's land-lines with the cables of the Western Brazilian Company, upon whose traffic we are dependent for our dividends, and also the frequent interruptions of those cables. However, it is satisfactory to know that the Western Brazilian are putting all the cables into efficient order. The interruptions during the current year have been far less frequent than in 1881, and the company is replacing its old cables, when damaged, with new sheath cable. It is, of course, less liable to injury. The Western Brazilian has recently re-established communication with Para, a most important station; and if the cable should continue working, we estimate our proportion of the receipts from this source will be worth £1,200 a year. At all events, we hope the period of deficits has passed; with increased traffic and improved cables our position ought to be improved. It does not so much depend upon us as upon the Western Brazilian Company. The land-line receipts are really more satisfactory than they appeared. There is a very fair increase of public messages. It will be observed from the balance-sheet that the debt of the Uruguay Government has grown from £7,448 to £8,311. We have not thought it right to consider as profit any portion of the land-line receipts which have not already been collected. We have carried forward, as usual, a large balance from the revenue account pending the payment by the Government of Uruguay, which has been so long outstanding. We have never ceased to urge upon the Uruguay Government to have this debt paid off, and we have also insisted, as far as we could, upon the prompt payment of their monthly message account, but the Government is generally in financial embarrassment. At the present moment there is almost a chronic state of revolution in those parts. Still there has been a desire, when they had money, to pay; and I think, probably, with time and patience, we may be able to realise this debt; but whether we realise it or not, we are taking care that it will not in any way prove injurious in the future to the shareholders of this company. If we get it, it will be so much to the good. We constantly have reason to believe that if the money was there we should get it. You are aware that some people have said, "Why should we continue carrying messages if they refuse to pay?" But under our convention with the Uruguay Government we are bound to carry their messages. I hope the debt which is now existing will prove to be paid. I think, gentlemen, these are all the remarks I need make, except one, that at our last meeting there was before us a gentleman who has taken a considerable interest in the affairs of this company, Colonel Tilney. I regret to say that since then he has passed away. I regret very much that we have not seen him here to-day. There is one other thing I will mention. An anonymous letter appeared in the *Times* commenting upon the honorarium of the directors of this company. Whoever wrote that letter was ignorant of the facts—or, if not ignorant, he has made a statement tending to influence in some way the shareholders. At the last meeting of the directors, they, of their own accord, reduced their honorarium. I may mention now what I did not mention then, that the present directors positively rescued from ruin this concern. But for them the affair would have been in such a state that it would have been impossible to get anything out of it. During the time the directors were working this company, all the money they got for rescuing it was a small sum. When the company was re-established as an English company, which was done at considerable expense, the old honorarium was retained. I am satisfied to-day that the directors working this concern are fully entitled to the remuneration which they have received. I should be very sorry that it should pass at any time into the hands of people upon a lower remuneration given for the returns they have given us, so far as their services have gone. At the present moment the Western Brazilian Company are negotiating with the Government of Brazil, with the object of the Government of Brazil taking over that system. That system includes our system also; and if these negotiations come to a satisfactory conclusion, we may require to call you together and then state the position you will occupy in that arrangement. All I can say at the present moment is that we shall take care of your interests and come to no conclusion without consulting the shareholders. With these remarks I beg to move, "That the report and accounts for the year ending 31st March, as submitted to the meeting, be adopted, and that a dividend of 3s. per share, free of income-tax, be declared payable this day."

Mr. J. Holcombe seconded the motion.

Mr. Kendall said that as the chairman had referred to the letter in the *Times*, he might say he had communications from sixty or seventy of the largest and most influential shareholders of this company.

The Chairman: Read the letter.

Mr. Kendall replied that the chairman had the list before him. He was not going to say a word about the conduct of the directors in managing the affairs of this company, but there were some very large and influential shareholders of the company who had communicated with him unsolicited, who expressed their strong disapproval of some of the charges, and also of the sum taken by the directors themselves. When they came to reflect—he was saying it in perfectly good faith—he was asked to say for other shareholders, and when they had those very large charges in the working expenses, which some people thought might be considerably reduced; and when they thought of the directors' fees too—and he should be sorry to say that in this matter the labourer was not worthy of his hire—when they took into account the directors' fees, one-ninth of the entire revenue of the company, he doubted whether there were not shareholders who would not say that the directors' fees are not absolutely excessive and indefensible in any way. He submitted that as that company was practically and almost entirely managed by the Western Brazilian Company, whether it was not in the interest of shareholders that the fees should be reduced. For his own part, he firmly believed that the best thing that could happen to this company would be an amalgamation or absorption into the Western Brazilian. Practically this company was in the hands of the Western Brazilian; they did the work of this company, and managed the land-lines, and he should think the best thing that could happen would be that the company should be amalgamated, or call it absorbed, in the Western Brazilian Company. There would be no difficulty about that; and if it did take place there would be a great saving of expenditure, which would just about amount to the dividend in itself. They would save a large expenditure in the costs and expenditure even in regard to their agent at Rio, and he thought negotiations should be entered into by which this company should be managed more than at present by the Western Brazilian Company, and this in the interest of the London Brazilian Company. For his own part he thought if the directors had put down £1,000 as their remuneration, that would have looked better. But they had put in the balance-sheet the full tether of their £1,200, and they gave back £200; and they took from the reserve fund £1,000, to enable them to pay the dividend. A large

number of shareholders had written to him objecting to these charges, and objecting also to the fees. He had come that day publicly to state the things that had been written to him in connection with this matter, but he thought personally that the fees were too large, considering the net revenue, the importance of the interests in charge, and the work to be done by the board. This was only a subsidiary concern to the Western Brazilian Company, and therefore he thought it would be better if they were amalgamated. He thought the directors would give way in the matter of their fees, in the interest of the shareholders. He had to propose an amendment, as follows:—"That the dividend as recommended by the board be declared and passed as usual; but that, in lieu of the adoption of the report and accounts, this meeting be adjourned to a date to be fixed by the board, in order that the board may take the necessary steps, by special resolution or otherwise, to alter the articles of association, and reduce the annual remuneration of the directors from £1,200 to £600."

Mr. Roberts: I will second that.

Mr. Goodsoll: Mr. Chairman, can you tell me the capital cost of the company's land-lines?

The Chairman: You shall have the figures directly; I cannot say off-hand.

The Chairman, continuing, said before he put the resolution, as these remarks must go before the shareholders, he should like to observe that the main points in Mr. Kendall's speech were the absorption of this company into the Western Brazilian. He might frankly say he had no objection to this company being absorbed in the Western Brazilian, for he knew the position this company occupied was superior to that of the Western Brazilian. The whole question would be question of terms. As he had been asked the capital cost of their land-lines, he might add that the exact figure was £90,000.

Mr. Goodsoll: I know from experience one does not get one's questions answered as one wishes unless one asks directly.

The Chairman: You are a director of the Western Brazilian Company, and a shareholder in this company.

Mr. Goodsoll said he was.

The Chairman: And you are talking about amalgamation.

Mr. Goodsoll: Pardon me, Mr. Pender, you must withdraw that. I have said nothing yet about amalgamation.

The Chairman said he simply wished to connect Mr. Goodsoll with the Western Brazilian. He thought there was some inspiration in the direction of amalgamation coming from Mr. Kendall.

Mr. Goodsoll: I have not heard a word from him about it.

Mr. Goodsoll continuing, said: The cost of the land-lines had been put at £90,000; he should like to know the duration of those lines, whether they lasted 20 or 100 years, for he thought on the face of things they ought to be writing off £2,500 for depreciation of capital. He thought they should find out the duration of the land-lines in that part of the world. He thought it was not proved that the £2,500 carried on to net revenue was net revenue at all, but should rather be a depreciation of £2,500, he thought, and not a profit of that amount.

Mr. W. Griffith said he thought there were signs of hope for the future, and he should like to ask whether it would not be possible to call in their debentures and borrow money at less rate.

In answer to a question from Mr. Goodsoll,

The Chairman said they maintained their land-lines, but he could not say anything about the life of the lines. As long as they spent money for maintaining these lines they did not think it desirable to make a special reserve for that.

Mr. Goodsoll: It is customary, I think.

The Chairman replied that this company was only yet three years old, and was now coming to active life. With regard to the debentures, they fall due in 1884. He only hoped that by 1884 the managers of this company will see their way to place the debentures at a price somewhat corresponding to the price on which other important telegraph companies had placed theirs. If the Western Brazilian were successful, it is possible that by that time, as Mr. Kendall had remarked, it would be one company. He should be glad to see it, if this company could maintain the position that they had made up their minds to maintain, that they were a first preference company. He would now put the amendment:—"That the dividend as recommended by the board be declared and paid as usual; but that, in lieu of the adoption of the report and accounts, this meeting be adjourned to a date to be fixed by the board, in order that the board may take the necessary steps, by special resolution and otherwise, to alter the articles of association, and reduce the annual remuneration of the directors from £1,200 to £600." Before putting that, he thought it would be right just to say that the history of this movement began with the late Colonel Tilney. Colonel Tilney took a sanguine view of the future of this company; but he had nothing to do with the company till it was rescued from Baron Grant's hands and placed in a sound position—until it was established as an English company. At that time Colonel Tilney made it a matter of business to buy shares in this company. Colonel Tilney then came to him and asked him to allow Mr. Kendall to come on that board. He (Mr. Pender) objected to any addition to the board at that time. He stated that negotiations were going on, and were being carried on by the men who had rescued the company from ruin, and that he thought they were the best men to carry on negotiations with the Western Brazilian Company to a successful termination; and he thought so still. If it was Colonel Tilney's object to place Mr. Kendall on that board to give him a certain position, then that was Colnel Tilney's question. It was not their intention to have Mr. Kendall on that board for the reasons he had given. He (Mr. Pender) was prepared to say that if Mr. Kendall made it a question of policy as to whether the present board were to conduct the negotiations or not, and carried his resolution, they were not likely to conduct them. The board had in their possession a very much larger number of proxies than Mr. Kendall went personally to the office to deliver the other day. As to Mr. Kendall being applied to unsolicited, he might say it was not usual for a large number of gentlemen to send a large number of proxies to other shareholders. Mr. Kendall was not known to the company except through Colonel Tilney, and he thought Mr. Kendall had some motive in coming there that day. He thought perhaps there had been some communication, perhaps one-sided communication, between Mr. Kendall and someone else, and he thought he ought to say, in the interests of shareholders, that the object of Mr. Kendall was to come on to that board.

Mr. Kendall: Not at all.

The Chairman: I am only telling you what you told me at your own house, and as Colonel Tilney told me. We shall produce proxies to carry the original resolution.

Mr. Kendall replied that he spoke in a commonsense manner. He had not solicited any of the letters he had received, and he had no intention of coming on to the board, or he should have taken the proper steps. He thought the board had a great deal less interest in the concern than he had, for the whole value of the board, he believed, did not amount to so much as the directors' fees. He thought it hardly came within the province of the chairman to say what he had said. This was not a question of shares.

Captain Pavy: I hold 4,000 shares in my own name.

Mr. Kendall said he thought the entire individual holding of the shareholders did not amount to the directors' fees. He thought it was only fair that the shareholders should say whether they accepted the resolution or the amendment.

Mr. Burt remarked that the amendment did not say anything about amalgamation. He thought the meeting was simply asked to adjourn in order that the directors might communicate with the Western Brazilian Company, and that the adjournment was simply with a view of having the articles altered. The question of amalgamation was a much more important one, and if Mr. Goodsoll had made Mr. Kendall's observations they might have some importance attached to them. He should be sorry if this board went to the Western Brazilian Board and said, "We want to amalgamate with you," especially as the Western Brazilian Company did not pay dividends. He questioned whether the Western Brazilian Company would create special preferential shares and hand them over to this company, and he also questioned whether such a thing should be expected.

The Chairman said he was sorry that Mr. Goodsoll, knowing that negotiations were going on with the Western Brazilian Company, should not have better taste than to appear there that day and identify himself with that movement as against the board. It looked very like as if there was some little desire to coerce this company into the views of the Western Company. Mr. Goodsoll knew the difficulty that existed between the two companies; and he left it to Mr. Goodsoll's good sense to allow the negotiations to be carried out without using a sort of pressure from without to bring the termination of the negotiations in favour of the Western Brazilian Company. He put these remarks because he knew Mr. Kendall had special reasons for knowing that every word uttered at that meeting would go to the shareholders, and he wished the shareholders to know that this movement sprang from a source which at the moment was inimical to their interests, and he wished them also to know that the board were looking after their interests.

Mr. Goodsoll: In what way have I said anything about amalgamation? There were certain things in the accounts which I wished cleared up, and I simply asked you to explain them. As I told you, there was nothing between Mr. Kendall and me. I have not spoken to Mr. Kendall for six months, and not upon this subject, so you must not make those grave statements.

The Chairman: I am very glad you accepted the remarks as grave. I simply say that you, as a director of the Western Brazilian and a shareholder, know that there are negotiations going on between this company and yours, and I therefore can quite see that this is a movement on the part of Mr. Kendall to affect these negotiations. It is a thing as old as the hills, and it is brought forward as something new and original. There is nothing in it, which you as a director of Western Brazilian know, we have not been always prepared to do. I have gone more than once to the board to endeavour to impress that upon them.

Mr. Goodsoll: I may just say that the meeting has heard me say what I have said, and it is true. I am not going to bandy words with Mr. Pender. It is simply a question—Is my word or his to be believed? Mr. Pender appears to put a different construction on my words from what I intended.

The Chairman: I am not questioning your truthfulness in the slightest; I only question your taste upon this subject brought forward by Mr. Kendall.

Mr. Appleton called attention to the fact that the amendment was simply a proposition for a reduction of the fees of the directors of this company. As the chairman had told them, and as some of them well knew, he thought that the services the directors at present on the board had rendered to this company, instead of deserving a reduction of fees, deserved an increase of fees. (Hear, hear.) He said that without any hesitation at all, knowing the history of the company. He was not going into the question of the services which Mr. Pender and his board had rendered to this company; they all knew the facts of the case; and if he were asked to vote for the amendment he should certainly vote against it and ask his fellow shareholders to do the same; not simply in the interests of this company, but as a matter of pure justice to the board. He thought the chairman had well indicated that that particular amendment did not aim at reduction of the fees *per se*. That was not the real object of the amendment, but it was to confuse, harass, and possibly to lead to some action of the board which would lead to their resignation.

Mr. Kendall: Oh, no; not at all.

Mr. Appleton: At any rate, if I misapprehend I withdraw it; but if I see you associated with a director of the Western Brazilian, and surrounded by gentlemen who are interested in the company, I have a right to draw my own inference. I should like to ask Mr. Goodsoll, as a director, who is presumably supporting Mr. Kendall in resisting the payment of these miserable fees. We pay £1,200 to our three directors, and we pay a dividend. What are the fees to the Western

Brazilian, who pay no dividend? At any rate, I will not press the question. I only wish to emphasise the point; and as regards the accession of Mr. Kendall to the board, I am not going to discuss the question; I have no doubt, if we could afford it, we might have you at the board.

Mr. Kendall: I don't want to go, sir.

Mr. Appleton: Your proposition is in utter contradiction of your own speech and your own logic, and I ask you to explain.

Mr. Kendall: Address the chairman.

Mr. Appleton: It seems a strange inconsistency between the amendment and the proposition, which I understand is really this, that he should move the reduction of the fees of three directors, when he and his directors have been endeavouring to get himself on to the board, which would cause a great increase of expenditure.

Mr. Kendall: They could not pay more.

Mr. Appleton: I have only to say with regard to the general broad amalgamation, you made use of the word absorption with the Western Brazilian. No doubt these gentlemen who represent the Western Brazilian are very desirous, as we are, to secure the amalgamation. The terms upon which the amalgamation is to be effected is the point at issue between the board, the shareholders, and these gentlemen. If we adopt this amendment which is but a cover for negotiations for amalgamation with the Western Brazilian, and approach the board with such a proposition, we shall find the terms of the amalgamation will be most disastrous to this company. I venture to appeal to my fellow-shareholders to support the board in resisting this cowardly amendment which is now before us.

Mr. Kendall: There is a curious element of jocularity about this good gentleman. I spoke without any ill-feeling. He calls me a coward

Mr. Appleton: No, no.

Mr. Kendall: Well, how can a man move a cowardly amendment without being a coward? When I moved this amendment, and in the remarks I made, they were only just giving utterance to my own ideas with regard to amalgamation in this matter. I think that amalgamation, or fusion, or absorption, is desirable. When I said that, I gave this board credit for having sense, and business-like ability and sagacity to make a good and favourable arrangement with the Western Brazilian Company. I took that all for granted, and believed no one in the world would dispute it. If you met them on fair ground, I believe you would worst the Western Brazilian.

The Chairman: Mr. Kendall now pats the board on the back, and encourages us by cutting down our salaries. I ask you, gentlemen, if that is quite right. Let us be plain, gentlemen. This I know pretty well, because I would not be worthy of sitting here otherwise: there is no doubt Mr. Kendall has been coquetting with the Western Brazilian Company with reference to these affairs. I know it, whatever Mr. Kendall may say; he cannot deny that. As Mr. Goodsoll has been kind enough to come here to-day, I would ask him a straightforward question. Has Mr. Goodsoll come here entirely from his own feelings as a shareholder of this company? Have you not been prompted by some director connected with the Western Brazilian to come and see whether you cannot bring a little pressure to bear? I just ask Mr. Goodsoll, as between me and himself, as two honourable men, whether he is not here under a certain inspiration not exactly his own, to endeavour to get a little pressure upon the shareholders in favour of our accepting rather better terms than we are prepared to accept from the Western Brazilian Company? I ask you the question plainly, Mr. Goodsoll.

Mr. Goodsoll: I came here to ask a question.

The Chairman: Then I assume that you did act under inspiration.

Mr. Goodsoll: Into that part of the question I decline to enter.

The Chairman: So far, then, I consider that I have not been suspecting in vain. The suggestions I have made are pretty well corroborated by the answer which Mr. Goodsoll has given.

The amendment was then put to the meeting, when four voted in its favour, as against eight for the original motion.

Mr. Kendall (handing in a paper to the chairman): I demand a poll.

The Chairman: The gentlemen who have sent in this paper demand a poll, and that must be accordingly arranged. The re-election of Captain Pavy is next to be proposed, which I accordingly do.

The motion was seconded by a shareholder and carried unanimously.

Messrs. Deloitte, Dever, Griffith & Co. were on the motion of Captain Pavy, seconded by Mr. Kendall, re-elected as auditors at a remuneration of 25 guineas per annum.

The Chairman: In regard to proxies for the poll we have got 12,834 votes as against Mr. Kendall's 8,385.

Mr. Kendall: In accordance with the articles I would demand a poll, and ask for a scrutiny.

The Chairman: Do you demand a poll on Capt. Pavy's election?

Mr. Kendall: No. I want to give the shareholders an opportunity of deciding in this matter.

The Chairman: Then let Mr. Kendall and the secretary deal with the scrutiny. I declare that a poll will be held immediately after the close of this meeting.

Captain Pavy: May I have an opportunity, as I understand a record of this meeting is going to the shareholders, of saying a few words regarding this amendment? Firstly, I thank the shareholders for re-electing me, and secondly I may observe that from the very commencement I have had to deal with this company, and I take some credit to myself that Mr. Pender took the position that he has. It has always, however, been my opinion that the proper place for it is in the bosom of the Western Brazilian. I started with that theory, and ever since not a single member of this board has advocated it as warmly as I have done. But we want conditions. I represent a considerable number of shareholders also, and I mean to watch over our interests as far as I can, as I hold a large number of shares myself. I think that it is rather for the Western Brazilian to put themselves in communication with us if they want to bring about any arrangement. And I am sure I am stating the sentiments of the board when I say that one and all we shall only be too glad to retire from our position and reap the benefit as shareholders if we get terms such as we have a right to expect

Mr. W. Griffith, in proposing a vote of thanks for the chairman, said there had been some conflict of opinion, but all would agree as to the urbanity and frankness of their able chairman, and whether or not he was the victor in this contest he would carry with him sentiments of respect and gratitude from those for whom he had worked in times past. He had managed the affairs of the company with great success, and he thought prosperity was dawning upon them, though they had been overclouded by adversity. It was only their bounden duty to express their thanks to their chairman.

Mr. Kendall seconded the motion, which was carried unanimously.

The Chairman in reply said: Gentlemen, I am quite prepared to put the whole of this question fairly and fully before the shareholders. There has been nothing suggested, except on one point, that we are not agreed upon, and therefore we shall take the opportunity of making the shareholders individually aware of the opinions held by the board in regard to the discussion which has taken place here to-day, and we shall make an address to the general body of shareholders, so that as a body they may understand exactly the position we have taken and intend to hold. I beg to thank you.

The result of the poll demanded by Mr. Kendall was declared immediately after the meeting had dispersed. The number of proxies against the amendment was 12,860, to which formal objection was taken to 1,718, and the number in favour of it 7,735, the original resolution being thus carried by a large majority.

THE ELECTRIC LIGHT AND POWER GENERATOR COMPANY, LIMITED.

AT the company's offices, No. 47, Cannon Street, on the 19th instant, at 12 o'clock, an extraordinary general meeting of the members of this company was held, under the presidency of Admiral Sir E. A. Inglefield. About thirty shareholders were present.

The notice convening the meeting, which the Secretary read, was as follows:—

"The Electric Light and Power Generator Company, Limited.—Notice is hereby given that an extraordinary general meeting of the members of the Electric Light and Power Generator Company, Limited, will be held at the company's offices, No. 47, Cannon Street, in the City of London, on Friday, the 19th day of May, 1882, at 12 o'clock precisely, for the purpose of confirming the following special resolutions, which were duly passed at an extraordinary general meeting of the members of the company held on the 3rd day of May, 1882:—'1. That the capital of the company be increased to the sum of £172,500 by the creation of 22,500 new shares of £1 each; 2. That the Bill as deposited by the company and introduced into the House of Commons be approved, and that the board be authorised to proceed with the same, subject to such conditions, alterations, or variations as the board or either House of Parliament may think fit to make therein.' Dated this 11th day of May, 1882. By order of the board, F. H. Landon, secretary. Company's offices, 47, Cannon Street, London, E.C."

The Chairman: You may remember that at our last meeting I stated that it would probably be necessary to call you together again to confirm the business brought forward on that occasion. We thought this might be combined with the general meeting; however, the Bill before Parliament has made such rapid progress that we have been advised that we shall be out of court if we do not get this second reading of our Bill through; that in fact we shall be excluded while the others will be passing before us. Under these circumstances, though we have had a sort of promise that we shall not be retarded if we will call this second meeting as quickly as possible, I hope there will be no delay; and we have called you before the general meeting more as a matter of form to confirm the resolutions of the last meeting. I think that is all I need say. I will read the two resolutions, then ask for your confirmation.

The resolutions were then read, put, and unanimously carried.

The Chairman: I may perhaps read you an extract from a letter lately received by us. It is from the United States Electric Lighting Company (the owners of the Maxim and Weston Patents in the United States, &c.), to the Electric Light and Power Generator Company Limited, dated New York, 1st May, 1882:—"We have one of our 50-light incandescent machines running 58 Maxim lamps in operation upon a ferry boat since October last. Seventy-five per cent. of the lamps originally erected are still in use, having burned more than 1,500 hours each; and not one lamp has failed since February 21st, although the lamps are burned daily nine hours or more." That is in reference to one of the most important features of our company, the Maxim lamp. It will be very interesting to the shareholders, therefore, to hear this; although we have only just received it I thought this would be an occasion upon which I was justified in reading it to you, to show you that the Maxim lamp stands out clearly over and above all others for its retaining power and its ability to last a great many hours. We find the results of experiments at our own works here and in Edinburgh to come quite up to our expectations. These two lamps just turned on by the machine below (alluding to electric lights which were attached to the gaselier in the room) are of our own manufacture, made in our own works, and moreover combining some improvements which we hope will considerably cheapen the cost. Platinum, as you know, is in New York used in large quantities, and this is expensive. We are able to substitute copper, and are able thus to make the lamp cheaper than hitherto. I am sorry I have not anything more to say. I think we must postpone anything further to the general meeting.

A Shareholder: May I ask if the wires are liable to create action by being exposed, or is it necessary to isolate them?

The Chairman: To which wires do you allude?

The Shareholder: To the wires connecting the machine with the lamp.

The Chairman: Well, there are the wires.

The Shareholder: But can they be detached without danger?

The Chairman: Yes. My idea is, that whenever we are able, to adapt our lamp to domestic purposes. Thus the actual gas pipes may be utilised for carrying the wires through or beside them. In all well-built houses the floors are capable of being taken up, so that there would be no difficulty in carrying in wires to houses already fitted with gas; and my own idea is that as covered wires they might be carried through the gas pipes in your house as tubes—used as tubes. They are your own fittings, and of course you can adapt them to your own purposes when the company has cut the gas off.

In reply to a question, the Chairman stated that the light could be secured from an engine working from one to one-and-a-half miles away. We burned these (he continued) for a considerable time from an engine the other side of Southwark Bridge, until we put an engine below stairs for experimental purposes. Until then we kept these lights going from the engine.

A Shareholder: How do you propose that these new shares shall be allotted?

The Chairman: They are actually part payment to the American Company as a portion of the old capital. We hand the shares to them, and they do what they like with them. They are not to be put on the market here. The reason for creating them is to meet a stipulation in the purchasing agreement, under which we must either give cash, or cash and shares to be created. At one time we thought it would be necessary to create a great deal more capital to keep ourselves on the same footing with other companies of enormous capitals. So far, with a good deal of work in progress, we have gone on. But this is certainly the better mode of paying—in shares rather than in money. We needed £32,000 in cash, and the rest in shares. Within the last month we have been able to get them to take £10,000 more in shares instead of cash, leaving us so much the more money to work out our principles.

Replying to a query upon the point, the Chairman said: The general meeting will be held in next month. It is necessary to get out all the accounts, with a full statement of the position of the company, and to attempt to do so without having had everything balanced would only be misleading and unsatisfactory to you and the shareholders. We shall send to each gentleman a copy of the statement of accounts beforehand.

THE FAURE ELECTRIC ACCUMULATOR COMPANY.

THE first ordinary general meeting of the shareholders of this company was held on the 23rd inst. at the City Terminus Hotel, Sir A. Otway, Bart., M.P. in the chair. The chairman said the company had not been formed for speculative or gambling purposes, but for the very important purpose of introducing to the public an invention which he considered was one of the most remarkable of modern times, for the storage and distribution of electricity under the patents taken out in this country by M. Faure. At the time of forming the company they had to deal with an entirely novel invention, but they had guided themselves at first by the advice of Mr. Phillippart, a gentleman who had had great experience, so far as experience could have been gained in the matter of accumulators. Mr. Philippart had recommended the company to arrange with an eminent firm at Liverpool for the supply of accumulators, suggesting afterwards that a construction company should be formed. The company had entered into arrangements of a tentative character with the Liverpool firm for the supply of a number of accumulators on terms which would give a fair profit to the company. Professors Ayrton and Perry, the engineers of the company, had been down to the manufactory at Liverpool, and had reported that the work was now progressing rapidly, and in a very satisfactory manner, 300 large accumulators being now ready, and the company was now prepared to turn out 300, or even 1,000 if necessary, a week. One of the principal difficulties the company had had to contend with had been the number of mysterious statements in the press and elsewhere as to the advent of another accumulator, which was to entirely surpass the Faure accumulator. The company had taken steps to protect themselves, and had retained the services of Sir William Thomson, who was of opinion that the new accumulator was an infringement of their patents. If that was the case, it proved all the more that the accumulator was a necessity for all the electric light companies. They had but one thing to be careful of, and that was to do nothing themselves to damage their own prospects. They had already made an arrangement with the Grand Hotel, where their accumulators would soon be at work, and an agreement would shortly be signed with the manager of a conspicuous theatre. They had also already lighted by means of their accumulators the Pullman train on the Brighton line. In conclusion, the chairman expressed the utmost confidence in the prosperous future of the company, half the capital of which had already been subscribed.

ANGLO-AMERICAN TELEGRAPH COMPANY.

AN extraordinary general meeting of the above company was held in Cannon Street Hotel on Thursday last. Viscount Monck in the chair. The object of the meeting was to consider and, if approved, to confirm and adopt an agreement made between the Company and the Direct United States Cable Company, Limited, La Compagnie Française du Télégraphe de Paris à New York, and the American Telegraph and Cable Company, with respect to the division and appropriation of the traffic receipts, the results of which would be that the joint receipts would be divided in the proportion of 55·125 to the Anglo Company, 18·375 to the Direct United States Company, 14·00 to the French Company, and 12·500 to the American Company, subject to certain modifications under certain specified contingencies.

The Chairman said that on the last occasion on which he had addressed the shareholders he had announced that the board had entered on a tentative and experimental policy with regard to the apprehended competition which the Direct United States Company had forced upon them. That policy was one of reduction of tariff. They had not then had sufficient experience to enable them to pronounce upon its success. Since that time their experience had been that that policy was not sufficiently encouraging to induce them to persevere in it, though there were not wanting indications that in the course of a few years their anticipations might have been realised. That period of waiting, however, would have cost too much time and money, and since the Jay-Gould cable had become an accomplished fact they had felt the necessity of abandoning the policy the lines of which had been indicated to them at the previous meeting. When they looked to the fact of the lower tariff being unremunerative, and of the keen competition that threatened them from the American cable, they had come to the conclusion, though not without some hesitation, that it was best on the whole that the interests of the rival companies should be blended; and they had therefore joined in the agreement which was submitted for their approval that day. They could not indeed go on sharing their traffic with every successive competitor, but unfortunately they had no control over those who instituted these competitions, and they had to do what men of common sense always did under such circumstances, accept the situation and make the best of it. He thought that they *had* made the best of it. The agreement gave them, as being the oldest and largest company, much the larger share of the receipts, and they had incidentally with the agreement established a connection with all the land lines of North America, and at the same time guarded themselves, as far as it was in their power to do, from competition in the future. He could assure them that such an agreement was, under the circumstances, the only practicable course that was open to the board to pursue.

The heads of agreement were then read, and the Chairman formally moved its adoption.

The motion was seconded by the Marquis of Tweeddale.

Mr. Francis Ferns complained that no copy of the agreement had been furnished to the shareholders. Before they were asked in brief terms to assent to a policy like this, they should have had an opportunity of ascertaining the terms which they were accepting. He thought that the course proposed would be a disastrous one. Why were they to be frightened at the name of Mr. Jay-Gould? Their dividend had dwindled down already from 6 to 1 per cent., and he was afraid that ere long they would be winding themselves up, and Mr. Jay-Gould would purchase the reversion. (Laughter.)

Mr. Jackson defended the policy of the board in consenting to the agreement before them. He was sure that looking to the facts which the chairman had placed before them, that they could not have done better. They had never had large dividends; but at any rate they had always been paid out of revenue, and he knew many railway companies in particular that were in the constant habit of paying dividends out of capital.

Mr. Seeley said all their amalgamations had been followed by a reduction of dividend, and he thought in consenting to this proposed arrangement they would be simply losing money and playing into the hands of cable manufactures and speculators. (Hear, hear.)

Mr. Newton said that as they had revised their tariff to 2s. per word on Monday last, why had they not made it 3s. If the public wanted such a number of cables they ought to be made to pay for them. Why, too, had the press, which was always abusing them, the advantage of sending messages at 8d?

Mr. Leach asked whether anything in this arrangement would prevent others from establishing a new cable? (Laughter.)

The Chairman briefly replied to the various questions that had arisen. He wished they had the power to keep the monopoly in their own hands, but they had not. The advantage which the press had arose from this, that their messages were sent during the slack hours of the day, and all their business telegrams were crowded into about six or eight hours, and that they did not use cipher. They had not sent the agreement to the shareholders in full, firstly, on economical grounds, and secondly, because a legal document such as that would not have been understood by any but a mere minority.

The resolution was then put to the meeting, and carried with three dissentients.

In reply to a shareholder, the Chairman stated that he could not say whether their receipts would continue to be published monthly, as that question would depend upon the consent of the other amalgamating companies. The proceedings then terminated.

DIRECT UNITED STATES CABLE COMPANY, LIMITED.

IMMEDIATELY after the meeting of the Anglo-American Telegraph Company, and in connection with the same agreement there discussed, the Direct United States Cable Company met in Cannon Street Hotel. Mr. John Pender, M.P., in the chair. The secretary having read the notice convening the meeting, the Chairman said that the agreement which they were met that afternoon to consider, had been forced upon them by the very formidable competition to which they had been subjected by their desire to maintain the dividend of 5 per cent., which they had paid for such a long time to their shareholders, and by the question of the shilling tariff. The negotiations which they had entered into and which had culminated in the agreement now before them had been delicate and complicated, but the result had been that, if adopted, their company would become partners in the most powerful combination in telegraphy that at the present time existed. The Great Western Union represented a capital of £10,000,000, and the length of wire under its control was 327,171 miles, while the total wire-mileage of the British Post Office system was only 116,680 miles. In referring to the question of tariff, Mr. Pender said that they had found the 2s. rate to be the most advantageous one for themselves. The sum was such a small charge to make upon the large mercantile transactions, which were usually conducted by cable, that the difference was never thought of. As an illustration of the time and space-annihilating power which their connection with the New World now gave them, he might mention that the name of the winner of the Derby on Wednesday was known in New York within 35 seconds of its being known in London.

The heads of agreement having been read, the Chairman put the resolution of adoption, which was seconded by Mr. W. Ford.

After a few congratulatory remarks from Mr. Jackson, the resolution was put to the meeting, and carried unanimously.

The proceedings then terminated.